Project Manual

for

2024 Cypress Falls HS Renovation

Cypress-Fairbanks Independent School District

January 13, 2024

PERMIT AND PROPOSAL SET

CFISD Project No: 24-02-5742-R-RFP
Arcadis Project Nos. 202318

ARCADIS

TEXAS ARCADIS INC.
P. O. Box 891209
Houston TX 77289 USA
(281) 286-6605
arcadiseducationtx.com

Project Manual

For

2024 Cypress Falls HS Renovation

Cypress-Fairbanks Independent School District

January 13,2025

PERMIT AND PROPOSAL SET

CFISD Project No: *24-02-5742-R-RFP*
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Board of Trustees

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Linda Macias, Ed.D….....Chief Academic Officer/Associate Superintendent
Karen Smith ..... Chief Financial Officer/Associate Superintendent
Dr. Deborah Stewart, Ed.D. .....Chief of Employee & Student Services/Associate Superintendent
Teresa Hull .....Chief of Staff /Associate Superintendent
Christina Cole.....Chief Officer for School Leadership / Associate Superintendent
Matt Morgan. .....Chief Operations Officer /Associate Superintendent
Marney Collins Sims.....General Council
Jesse Clayburn .....Assistant Superintendent of Facilities and Construction
Dan Grosz, ALEP .....Director of Design and Facilities Planning
Amy Hayes.....Director of Contract Management
Shannon Thompson .....Director of Project Management
Steven Bryan .....Director of Construction Field Services

Texas Arcadis Inc.

Project Manual

For

2024 Jersey Village HS Renovation

Cypress-Fairbanks Independent School District

January 13,2025

BID SET

CFISD Project No: *24-02-5743-R-RFP*
Arcadis Project Nos. 202319

Consultants

CIVIL
Brooks and Sparks
21010 Park Row
Katy, Texas 77449
Phone: (281) 578-9595
Fax: (281) 578-9686

MEP
Salas O'Brien, LLC
10930 W. Sam Houston Pkwy
N., Suite 900
Houston, Texas 77064
Phone: (281) 664-1990

STRUCTURAL
CJG Engineers
3200 Wilcrest Drive, Ste 305
Houston, Texas 77042
Phone: (713) 780-3345
Fax: (713) 780-3712

FOOD SERVICE
Surcana Foodservice Design
15015 Fondren Rd.
Missouri City, TX 77489
Phone: (281) 224-1230

ACOUSTICAL
BAi, LLC
4726 Rainbow Run
Sugarland, Texas 77479
Phone: (281) 813-8518

THEATER
Wrightson, Johnson, Haddon & Williams
12175 Network Boulevard
Suite 150
San Antonio, TX 78249
Phone: (972) 934-3700

LANDSCAPE
Landesign Group
17041 El Camino Real Ste. 204
Houston, TX 77058
Phone: (281) 486-4040

Texas Arcadis Inc.

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Cypress-Fairbanks Independent School District
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REQUEST FOR COMPETITIVE SEALED PROPOSALS

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

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

ARCHITECT: Texas Arcadis, Inc.
1330 Post Oak Blvd.
Houston, Texas 77056

PROJECT: **2024 Cy Falls HS Renovation**
CFISD Proposal Number: 24-02-5742-R-RFP

LOCATION: **9811 Huffmeister Rd., Houston, Texas 77095**

PROPOSED CONSTRUCTION BUDGET: **$13,942,479.69**

PRE-PROPOSAL CONFERENCE: **Wednesday, January 22, 2025, at 10:00 AM** at Cypress-Fairbanks Independent School District, Facilities & Construction Conference Room, 11430-B Perry Road, Houston, Texas 77064. Representatives of the Architect and Owner will be present at this meeting. All offerors are encouraged to attend.

PROPOSAL DATE AND TIME: **Thursday, February 6, 2025** Base Proposal: 2:00 PM
Alternate Proposal: 3:00 PM

LOCATION OF PROPOSAL OPENING: Cypress-Fairbanks Independent School District
Facilities and Construction
11430-B Perry Road
Houston, Texas 77064
(281) 897-4108

SITE VISIT **Wednesday, January 22, 2025**, immediately following the pre-proposal conference. Meet at the front entrance to Cy Falls High School, located at 9811 Huffmeister Rd., Houston, Texas 77095.

Proposal Documents will be available on/after **Monday, January 13, 2025**. General Contractor Offerors may obtain two (2) sets of drawings and specifications at the place identified below upon deposit of **$300.00** per set with check made payable to **Texas Arcadis, Inc**. The deposit will be returned when the Plans and Specifications are returned in good condition. Additionally, General Contractor Offerors must submit of 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

Office of Triangle Printing and Marketing
8168 Westpark Drive
Houston, Texas 77063
713-780-0236

FULL REFUND: Deposits will be returned provided all Contract Documents and addenda are returned to the Architect complete with all sheets bound in their original order within ten (10) days of the opening of proposals.

FORFEIT OF DEPOSIT: When the Documents are not returned under the conditions specified, none of the deposit will be returned. However, the Documents shall remain the property of the Owner and must be returned.

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)
2024 Cy Falls HS Renovation
Cypress Fairbanks Independent School District
Cypress-Fairbanks I.S.D. Proposal Number: **24-02-5742-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. 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

DOCUMENT AB

INSTRUCTIONS TO OFFERORS

1. QUALIFIED OFFERORS

A. Proposals will be accepted from qualified General Contractors only for the entire scope of work described in the Contract Documents. As a prerequisite to a Contractor's qualifying for the award of contract on this work, the Contractor must complete each item of the Contractor Information and Experience Statement (AIA Document A305™). The Statement forms may be obtained from the office of the Houston Chapter of the American Institute of Architects (A.I.A), 315 Capitol, Suite 120; Houston, TX 77002. The Statement and 3 references of similar projects with current/verified phone numbers, email address and current/verified fax numbers for references of Owner and Architect (refer to Exhibit A on page 9), shall be submitted digitally to the Architect via email (Shanika.reed@arcadis.com) by **5:00P.M. CST on Thursday, January 23, 2025.**

B. Every interested Offeror shall be required to submit AIA Document A305™ (Contractor's Information and Experience Statement) to Architect. AIA Documents submitted by fax transmission will not be accepted.

C. The primary purposes of the evaluation process will be to:
1. Gather information for the Owner's evaluation procedure.
2. Enable the Architect to evaluate the Contractor's qualifications and determine which Contractors the Architect could recommend to the Owner should such recommendation be requested by the Owner.

D. After completion of the Contractor evaluation process, the Architect will notify the Owner and each Contractor who has submitted a Contractor's Qualification Statement as to the Architect's opinion. In the event the Owner chooses to determine the acceptability of Contractors prior to receipt of Proposals, the Contractors will be notified of the Owner's decision prior to the proposal date, otherwise the Owner will make his decision after receipt of proposals.

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

F. In the event an Offeror fails to submit the specified Contractor's Qualification Statement in accordance with the schedule established, such noncompliance shall be considered by both the Owner and Architect as a negative factor in the determination of the successful Offeror.

G. In the event the Architect notifies a Contractor that it is the Architect's opinion the Contractor has not sufficiently demonstrated his qualifications to perform the subject Contract, taking into consideration the items listed under Paragraph 19.A and the Contractor subsequently decides to submit a Proposal, the Contractor shall be doing so with the knowledge that the Architect will not recommend him as a qualified Offeror.

2. OFFEROR'S PRESENTATION

Each Offeror by making their Proposal represents that:

A. The Offeror has read and understands the Proposal Documents and their Proposal is made in accordance therewith.

B. The Offeror has visited the site, has familiarized themselves with the local conditions under which the work is to be performed and has correlated their observations with the requirements of the proposed Contract Documents.

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 A201™-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.

B. No substitution will be considered prior to receipt of proposals unless written request for approval has been received by the Architect at least ten (10) days prior to the date for receipt of proposals. Each such request shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitute including drawings, cuts, performance and test data and any other information necessary for an evaluation. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

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

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

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

A. The use of asbestos or PCB's in any construction process is strictly prohibited

B. Prior to submitting a proposal, Offerors shall notify the Architect, in writing, of any materials, products and systems in these specifications which are known to contain or are likely to contain asbestos, lead or PCBs. The Architect will promptly explore possibilities for selecting other materials, products and systems which would circumvent the problem and notify Offerors of any changes in an addendum, otherwise it will be understood that only specified materials, products and systems that are asbestos, lead, and PCB free are included in the proposals.

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:
2024 Cy Falls HS Renovation
Cypress-Fairbanks Independent School District
Cypress-Fairbanks ISD Proposal Number: 24-02-5742-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 Friday, February 7, 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 **March 3, 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

2024 Cy Falls HS Renovation

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

2024 CY FALLS HS RENOVATION
Cypress-Fairbanks Independent School District
Cypress-Fairbanks I.S.D. Proposal Number: 24-02-5742-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 **Texas Arcadis, Inc.** dated **January 13, 2025,** and having examined site conditions, the undersigned proposes to furnish all labor, equipment and materials and perform all work for the completion of the above-named project for the sum indicated below.

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

1. Hold 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, FEBRUARY 6, 2025

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.

_____
Authorized Signature

_____
Printed Name

_____
Title

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

_____
Name of Contracting Firm

_____
Address

_____
Telephone

_____
Date

FORM AC
COMPETITIVE SEALED PROPOSAL FORM - ALTERNATE PROPOSALS

2024 CY FALLS HS RENOVATION
Cypress-Fairbanks Independent School District
Cypress-Fairbanks I.S.D. Proposal Number: 24-02-5742-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 **Texas Arcadis Inc**, dated **January 13, 2025**, and having examined site conditions, the undersigned proposes to furnish all labor, equipment and materials and perform all work for the completion of the above-named project for the sum indicated below.

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

1. Hold 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)

II. UNIT PRICES

If the Owner accepts any or all of the Alternates, the undersigned agrees to add or subtract the following units of work:

UNIT PRICE 1: ELECTRICAL DUPLEX RECEPTACLE $_____/ each

UNIT PRICE 2: DATA DROP $_____/ each

UNIT PRICE 3: 4 ½" THICK CONCRETE WALK PER SQUARE FOOT $_____/ sq. ft

THIS PAGE OF PROPOSAL FORM MUST BE SUBMITTED BY 3:00 PM, FEBRUARY 6, 2025

UNIT PRICE 4: 7" THICK CONCRETE DRIVE PER SQUARE FOOT $_____/sq. ft

UNIT PRICE 5: CHAIN LINK FENCE

1.	4-foot-high fence	$_____/	linear foot
2.	4-foot-high x 3-foot-wide gate	$_____/	per leaf
3.	4-foot-high x 6-foot-wide gate	$_____/	per leaf
4.	6-foot-high fence	$_____/	linear foot
5.	6-foot-high x 3-foot-wide gate	$_____/	per leaf
6.	6-foot-high x 6-foot-wide gate	$_____/	per leaf

UNIT PRICE 6: LIFE SAFETY DEVICES (including all associated cabling and programming)

1.	Exterior Horn to Speaker	$_____	each
2.	Interior Horn to Speaker	$_____	each
3.	Interior Visual Strobe	$_____	each
4.	Interior Speaker/Visual Strobe	$_____	each
5.	Smoke Detector	$_____	each
6.	Heat Detector	$_____	each
7.	Manual Pull Station	$_____	each
8.	Stopper 2 Pull Station Cover	$_____	each
9.	Annunciator Panel	$_____	each
10	Duct Detector	$_____	each
11	Relay	$_____	each
12	Supervisory	$_____	each
13	Waterflow	$_____	each
14	Amplifier	$_____	each
15	Remote Power Supply	$_____	each

UNIT PRICE 7: 4" RESILIENT BASE 100 LINEAR FEET $_____/ linear foot

UNIT PRICE 8: GRAPHIC SIGNS

1.	Sign Type A	$_____/	each
2.	Sign Type B	$_____/	each
3.	Sign Type C	$_____/	each
4.	Sign Type D	$_____/	each
5.	Sign Type E	$_____/	each
6.	Sign Type F	$_____/	each
7.	Max Occupancy Signage	$_____/	each

THIS PAGE OF PROPOSAL FORM MUST BE SUBMITTED BY 3:00 PM, FEBRUARY 6, 2025

8.	FDC Connection Signage	$_____/	each
9.	Wayfinding Signage (2 lines text)	$_____/	each
10.	Wayfinding Signage (3 lines text)	$_____/	each
11.	Wayfinding Signage (4 lines text)	$_____/	each

UNIT PRICE 9: PAINTING $_____/sq. ft

UNIT PRICE 10: EXIT SIGN $_____/each

UNIT PRICE 11: ORNAMENTAL FENCE

1.	6-foot-high fence	$_____/	linear foot
2.	6-foot-high x 4-foot-wide gate	$_____/	per leaf
3.	6-foot-high x 6-foot-wide gate	$_____/	per leaf

UNIT PRICE 12: SECURITY FILM.

1.	Armoured One	$_____/	Square foot

UNIT PRICE 13: ACCESS CONTROL/ INTRUSION DEVICES $_____/ each

UNIT PRICE 14: DATA INFRASTRUCTURE $_____/ each

UNIT PRICE 15: REPLACE UNDERREAMED FOOTINGS WITH STRAIGHT SHAFT DRILLED FOOTING

1.	36-inch diameter	$_____/	LF
2.	42-inch diameter	$_____/	LF
3.	48-inch diameter	$_____/	LF
4.	60-inch diameter	$_____/	LF

UNIT PRICE 16: WALL SLEEVES $_____/ linear foot

III. CONTRACTOR'S PROJECT TEAM MEMBERS

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

Project Manager _____

Superintendent _____

Asst. Superintendent(s) _____

Project Engineer _____

III. PROPOSED SUBCONTRACTORS

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 Building: _____

Glazing: _____

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

_____
Authorized Signature

_____
Printed Name

_____
Title

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

_____
Name of Contracting Firm

_____
Address

_____
Telephone

_____
Date

END OF FORM

FORM AD

PROPOSAL BOND

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

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal has submitted the accompanying Proposal, dated _____, _____, being for the _____, Cypress-Fairbanks I.S.D. Proposal Number: **24-02-5742R-RFP** for the Cypress-Fairbanks Independent School District, the kind and extent of work involved being set forth in detail in the proposed Contract Documents cited herein.

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

IN WITNESS WHEREOF, the above bonded parties have executed this instrument under their several seals this _____ 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.

_____ _____
Business Address Individual Principal: Signature and Printed Name

_____ _____
Business Address Individual Principal: Signature and Printed Name

ATTEST:

_____ BY: _____
Secretary President

_____ _____
Business Address Corporate Surety

ATTEST: _____ BY: _____

END OF FORM

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

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: **2024 Cy Falls HS Renovation**
ARCHITECT: Texas Arcadis, Inc.

(Name, address) Cypress-Fairbanks Independent School District
Cy-Fair I.S.D. Proposal Number: **24-02-5742-R-RFP**
Houston, Harris County, Texas

TO: (General Contractor)

DATE:

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

Work/ Division	Firm	Address	Phone	Fax	e-mail	Representative

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

2024 CY FALLS HS RENOVATION

Cypress-Fairbanks ISD Proposal Number: 24-02-5742-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 form 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

2024 CY FALLS HS RENOVATION

Cypress-Fairbanks ISD Proposal Number: 24-02-5742-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 3: CONDITIONAL WAIVER FOR FINAL PAYMENT

****

CONDITIONAL WAIVER AND RELEASE ON FINAL PAYMENT

Cypress-Fairbanks Independent School District

2024 CY FALLS HS RENOVATION

Cypress-Fairbanks ISD Proposal Number: 24-02-5742-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 properly endorsed and has been paid by the bank on which it is drawn, this document becomes effective to release any mechanic's lien right, any right arising from a payment bond that complies with a state or federal statute, any common law payment bond right, any claim for payment, and any rights under any similar ordinance, rule, or statute related to claim or payment rights for persons in the signer's position that the signer has on the property of **Cypress-Fairbanks Independent School District** (owner) located at _____ (location) to the following extent: _____ (job description).

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

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

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

Date _____

_____ (Company name)

By _____ (Signature)

_____ (Printed/Typed name)

_____ (Title)

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

_____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

2024 CY FALLS HS RENOVATION

Cypress-Fairbanks ISD Proposal Number: 24-02-5742-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: **2024 Cy Falls HS Renovation**
Cypress-Fairbanks I.S.D. Proposal Number: **24-02-5742-R-RFP**
Architect's Project Number: **202318**
Address: _____

OWNER NAME: Cypress-Fairbanks Independent School District ***Phone No. (281) 897-4108***

_____ Warrants _____
(Name of Company) (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: **2024 Cy Falls Renovation**

Cypress-Fairbanks I.S.D. Proposal Number: **24-02-5742-R-RFP**

Architect's Project Numbers: **202318**

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

CERTIFICATION OF PROJECT COMPLIANCE

Completion of this form is required under the provisions of §61.1036(c)(3)(F) TAC for all public school district construction projects. Instructions for completion of this form can be found on page 2.

1. PROJECT INFORMATION

Facility: 2024 Cy Falls HS Renovation

Address: 9811 Huffmeister Rd.

City: Houston, TX 77095

DISTRICT: Cypress-Fairbanks I.S.D.

ARCHITECT/ENGINEER: Arcadis

CONTRACTOR/CM: TBD

CONTRACT DATE: TBD

DATE DISTRICT AUTHORIZED PROJECT: 2019 Bond authorized 5/4/19, Phase 6 authorized 11/1/23

BRIEF DESCRIPTION OF PROJECT:

CFISD Project Number: 24-02-5742-R-RFP

Various renovations, program additions, mechanical/electrical/plumbing upgrades and security enhancements to an existing high school.

2. CERTIFICATION OF DESIGN AND CONSTRUCTION

The intent of this document is to assure that the school district has provided to the architect/engineer the required information and the architect/engineer has reviewed the School Facilities Standards as required by the State of Texas, and used his/her reasonable professional judgment and care in the architectural/engineering design and that the contractor has constructed the project in a quality manner in general conformance with the design requirements and that the school district certifies to project completion.

3. The District certifies that the educational program and the educational specifications 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:** 2/29/2024

4. The Architect/Engineer certifies the above information was received from the school district, and that the building(s) were designed in accordance with the applicable building codes. Further, the facility has been designed to meet or exceed the design criteria relating to space (minimum square footage), educational adequacy, and construction quality as contained in the School Facilities Standards as adopted by the Commissioner of Education, June 9, 2003, and as provided by the district.

ARCHITECT/ENGINEER: Arcadis **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/CM: TBD **BY:** **DATE:**

6. The District certifies 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
- – name of the school district
- – the Architect/Engineer and Contractor
- – the date of execution of the construction contract
- – the date that the school district authorized the superintendent to hire an architect/engineer
- – scope of the project.

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

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

Section 4. This section is to be executed by the architect/engineer upon completion of the plans and specifications and in conjunction with the completion of the plan review for code compliance (ref. 19 TAC §61.1033 or §61.1036, 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.

FORM AM

REQUEST FOR CLARIFICATION DURING PROPOSAL PROCESS

All clarifications requested during the proposal process must be submitted in written form using the form provided. Fax form to the attention of Architect. All pertinent responses to clarification requests will be made by addenda to the Contract Documents.

PROJECT: _____

CONTRACTOR: _____

SUBMITTED BY: _____

PRINTED NAME: _____

TITLE: _____

TELEPHONE: _____

FAX: _____

EMAIL: _____

CLARIFICATION REQUESTED	ARCHITECT USE

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.cfisd.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.

_____
Authorized Signature

_____
Printed Name

_____
Title

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

_____
Name of Contracting Firm

_____
Address

_____
Telephone

_____
Date

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

	Contractor's Initials	Architect's Initials	CFISD PM Initials
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. *CPR Execution Complete (Owner)* ☐ 2. *Account Balance Review (Owner)* ☐ 3. Executed Final Change Order			
Architect letter confirming all punch list items complete ***(Architect)*** ☐ 1. Final Signed Off Punch list			
List of All Permits during Job and a Copy of All Permits			
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			

PROJECT CLOSE OUT – FORM AO

	Contractor's Initials	Architect's Initials	CFISD PM Initials
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. *Transmit Originals to Maintenance, Keep Copies for File. (Owner)*			
Letter from Building Envelope Consultant confirming all deficiency items complete			
Roofing Warranty & Documentation ☐ *Send Copies to Director of Maintenance (Owner)* ☐ 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			
Letter from Test & Balance Consultant confirming all deficiency items complete			
Letter from Commissioning Consultant confirming all deficiency items complete			
Letter from Structural Engineer confirming conformance with design **(provided by Architect)**			
Letter from Civil Engineer confirming conformance with design **(provided by Architect)**			

PROJECT CLOSE OUT – FORM AO

	Contractor's Initials	Architect's Initials	CFISD PM Initials
Letter from Mechanical Engineer confirming conformance with design **(provided by Architect)**			
Letter from Materials Testing Consultant confirming all deficiency items complete			
Letter from Consultants confirming conformance with design if applicable ***(Provided by Consultant, FDP,* C-H, etc.)**			
Copy of all Gas Pipe Test Results Form			
Elevators ☐ Maintenance Service Agreement ☐ Send Copy to Maintenance (Owner)			
General Contractor's Written Guarantee **(Form AJ)** ☐ 1. Check for Notary ☐ 2. Check for Original Signature ☐ 3. Check for Project Name			
Subcontractors' Written Guarantee **(Form AJ)** ☐ 1. Check against Subcontractor List ☐ 2. Check for Original Signature ☐ 3. Check for Project Name ☐ 4. Check for Notary ☐ 5. State date to be date of Substantial Completion of final phase of project			
Extended Warranties & Maintenance List			
Insurance Certificate documenting continuing coverage after Final Payment **(see AIA Document A201 ™–2017, as amended, Article 11.1.3)**			
Workers' Compensation Certificates ☐ General Contractor ☐ ALL Subcontractors			
All Extra Stock Transmittals by Division ☐ Divisions 0 – 21 ☐ Division 22 Plumbing ☐ Division 23 HVAC ☐ Division 26 Electrical ☐ Division 27, 28 and beyond as applicable			
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			

PROJECT CLOSE OUT – FORM AO

	Contractor's Initials	Architect's Initials	CFISD PM Initials
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-Builts ☐ 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:

11430 B Perry Rd.
Houston, Texas 77064

CYPRESS FAIRBANKS
INDEPENDENT SCHOOL DISTRICT
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Phone: 281-897-4108

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

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Houston, Texas 77064

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Phone: 281-897-4108

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.

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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

11430 B Perry Rd.
Houston, Texas 77064

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Phone: 281-897-4108

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

Filled out by Service Provider					**For CFISD Use**	
Employee Name *(Last Name, First Name)*	**Gender** *(Male, Female)*	**Birth Date** *(Month, Day, Year)*	**Race**	**U.S Government Issued Picture ID Number and Type**	**V-Soft Cleared** *(Sign & Date)*	**Badge Issued** *(Sign & Date)*

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FACILITIES PLANNING AND CONSTRUCTION

CERTIFICATE OF FINAL COMPLETION (AQ)

Project Name:	2024 Cy Falls HS Renovation	Project No.:	24-02-5742-R-RFP
Contractor:			
Contract No.:	202318	Contract Date:	
Architect/Engineer:	Texas Arcadis, Inc.		
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.

Project Manager	*(Print Name)*	*(Date)*

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

Project Architect	*(Print Name)*	*(Date)*

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

Project Manager	*(Print Name)*	*Date)*
Director of Construction Field Services	*(Print Name)*	*(Date)*
Director of Project Management	*(Print Name)*	*(Date)*
Director of Contract Management	*(Print Name)*	*(Date)*
Assistant Supt. of Facilities & Construction	*(Print Name)*	*(Date)*
Chief Operations Officer *Associate Supt. of Facilities, Construction & Support Services*	*(Print Name)*	*(Date)*

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.

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 is _____, _____, _____, _____, _____.
(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

Form provided by Texas Ethics Commission www.ethics.state.tx.us Revised 12/22/2017

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

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 ($00.00), 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)

« »
« »
« »
« »
« »
« »

§ 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	Application for Payment Checklist		
Section CB	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 Exhibit F	Section 01 35 23 Special Owner Requirements 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)*	**CONTRACTOR** *(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)	*(Printed name and title)*

FORM BB

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

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

_____

_____

(hereinafter called the Obligee) in the amount of _____

_____

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

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

2024 CY FALLS HS RENOVATION
CYPRESS-FAIRBANKS INDEPENDENT SCHOOL DISTRICT
CYPRESS-FAIRBANKS I.S.D. PROPOSAL NUMBER: 24-02-5742-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 _____, _____.

_____ (Seal)
Principal

_____
Surety Address

By: _____
Signature and Printed Name

_____ (Seal)
Surety

_____
Surety Telephone Number

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 _____, _____.

2024 CY FALLS HS RENOVATION
CYPRESS-FAIRBANKS INDEPENDENT SCHOOL DISTRICT
CYPRESS-FAIRBANKS I.S.D. PROPOSAL NUMBER: 24-02-5742-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 _____, _____.

_____ (Seal)
Witness: Principal

_____ By: _____
Signature and Printed Name

Witness: _____ (Seal)
Surety

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

_____

_____ _____
Surety Address Surety Telephone Number

SECTION BD

INSURANCE AND BONDS REQUIREMENTS FOR CONTRACTORS AND FACILITY RENTERS

**CYPRESS-FAIRBANKS INDEPENDENT SCHOOL DISTRICT
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.

2. The contractor must provide a certificate of coverage to the governmental entity prior to being awarded the contract. The certificate shall show Cypress-Fairbanks Independent School District as the certificate holder. The policy must be endorsed to provide a "waiver of subrogation in favor of Cypress-Fairbanks Independent School District."

3. If the coverage period shown on the contractor's current certificate of coverage ends during the duration of the project, the contractor must, prior to the end of the coverage period, file a new certificate of coverage with the governmental entity showing the coverage has been extended.

4. The contractor shall obtain from each person providing services on a project, and provide to the governmental entity:

    a. a certificate of coverage, prior to that person beginning work on the project, so the governmental entity will have on file certificates of coverage showing coverage for all persons providing services on a project; and

    b. no later than seven (7) days after receipt by the contractor, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the project.

5. The contractor shall retain all required certificates of coverage for the duration of the project and two (2) years thereafter.

6. The contractor shall notify the governmental entity in writing by certified mail or personal delivery, within 10 days after the contractor knows or should know, of any change that materially affects the provision of coverage of any person providing services on the project.

7. The contractor shall post on each project site a notice, in the text, form and manner prescribed by the Texas Workers' Compensation Commission, informing all persons providing services on the project that they are required to be covered, and stating how a person may verify coverage and report lack of coverage.

8. The contractor shall contractually require each person with whom it contracts to provide services on a project, to:

    a. provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code, Section 401.011 (44) for all of its employees providing services on the project, for the duration of the project. The policy must be endorsed to provide a "waiver of subrogation" in favor of Cypress-Fairbanks Independent School District;

    b. provide to the contractor, prior to that person beginning work on the project, a certificate of coverage showing that coverage is being provided for all employees of the person providing services on the project, for the duration of the project. The certificate shall show Cypress-Fairbanks Independent School District as the certificate holder;

    c. provide the contractor, prior to the end of the coverage period, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the project;

    d. obtain from each other person with whom it contracts, and provide to the contractor:

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

2) a new certificate of coverage showing extension of coverage, prior to the end of the coverage period, if the coverage period shown on the current certificate of coverage ends during the duration of the project.

e. retain all required certificates of coverage on file for the duration of the project and for one year thereafter;

f. notify the governmental entity in writing by certified mail or personal delivery, within 10 days after the person knew or should have known, of any change that materially affects the provisions of coverage of any person providing services on the project; and

g. contractually require each person with whom it contracts to perform as required by paragraphs a - g, with the certificates of coverage to be provided to the person for whom they are providing services.

9. By signing this contract or providing or causing to be provided a certificate of coverage, the contractor is representing to the governmental entity that all employees of the contractor who will provide services on the project will be covered by workers' compensation coverage for the duration of the project, that the coverage will be based on proper reporting of classification codes and payroll amounts, and that all coverage agreements will be filed with the appropriate insurance carrier or, in the case of self-insured, with the commission's Division of Self-Insurance Regulation. Providing false or misleading information may subject the contractor to administrative penalties, criminal penalties, civil penalties, or other civil actions.

10. The contractor's failure to comply with any of these provisions is a breach of contract by the contractor which entitles the governmental entity to declare the contract void if the contractor does not remedy the breach within ten days after receipt of notice of breach from the governmental entity.

11. The Contractor shall post the following language:

REQUIRED WORKERS' COMPENSATION COVERAGE

"The law requires that each person working on this site or providing services related to this construction project must be covered by workers' compensation insurance. This includes persons providing, hauling, or delivering equipment or materials, or providing labor or transportation or other service related to the project, regardless of the identity of their employer or status as an employee." Furnish copies of Workers' Compensation coverage for each person working on the project.

"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."

B. Commercial General Liability Insurance (Occurrence basis only).

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.: _____

Project: 2024 Cy Falls HS Renovation Architect's Proposal Number: 202318

Owner: Cypress-Fairbanks Independent School District Architect: Texas Arcadis, Inc.

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: _____

AIA® Document A201® – 2017

General Conditions of the Contract for Construction

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

2024 CY FALLS HS RENOVATION
CFISD Project Number: 24-02-5742R-RFP
Architect Project No. 202318

CAMPUS ADDRESS:
9811 Huffmeister, Houston, Texas 77095

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)

Texas Arcadis, Inc.
1330 Post Oak Blvd.
Houston, TX 77056
281-286-6605

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

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

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

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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, 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 Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or a Change Proposal Request, or (4) a written order for a minor change in the Work issued by the Architect.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. 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 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 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.

(Paragraphs deleted)

§ 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.

(Paragraph deleted)

§ 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, 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 Execution of Contract Documents

§ 1.5.1 The 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 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 Ownership and Use of Drawings, Specifications and Other Instruments of Service

§ 1.6.1 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.

(Paragraphs deleted)

§ 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 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. 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 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 Information and Services Required of the Owner

§ 2.2.1 Prior to commencement of the 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. 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 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 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 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 Owner's Right to Stop the Work

(Paragraphs deleted)

§ 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 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 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 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 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 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.

(Paragraphs deleted)

§ 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 and for coordinating all portions of the Work under the 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 or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely 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 authorized by the Architect in accordance with Sections 3.12.8 or 7.4, the Contractor may make substitutions only with prior written consent of the Owner, after evaluation by the Architect and in accordance with a 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

(Paragraphs deleted)

§ 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 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. 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.

(Paragraphs deleted)

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

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

(Paragraphs deleted)

§ 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 Schedules

§ 3.10.1 The 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 not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and 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 shall prepare a submittal schedule, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, and shall submit the schedule(s) for the Architect's approval. The Architect's approval shall not unreasonably be 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, 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 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 one (1) copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Architect 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 and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

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

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

§ 3.12.4 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. Their purpose is to demonstrate 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. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

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

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

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically 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, 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 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 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.

(Paragraphs deleted)

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

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall, on a daily basis, keep the premises and surrounding area free from accumulation of waste materials 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 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 Owner shall be entitled to reimbursement from the Contractor.

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

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

§ 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 Architect

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

§ 4.1.3 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 (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 unless otherwise modified in writing in accordance with other provisions of the Contract.

§ 4.2.2 The Architect 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, 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 completed, will be in accordance with 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 The Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and report to the Owner (1) known deviations from the Contract Documents and from the most recent construction schedule submitted by the Contractor, and (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 and will not be responsible for acts or

omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work. The Architect shall endeavor to guard the Owner against defects and deficiencies in the Work.

§ 4.2.4 Communications Facilitating Contract Administration

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 shall be through the Owner.

§ 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 13.5.2 and 13.5.3, whether or not 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, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness 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 and 3.12. The Architect's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Architect, of any construction means, methods, techniques, sequences or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders, Change Proposal Requests, and Construction Change Directives, and may authorize minor changes in the Work as provided in 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; will receive and forward to the Owner for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor, and will issue a final Certificate for Payment 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 representatives to assist in carrying out the Architect's responsibilities at the site.

§ 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 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 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

(Paragraph deleted)

§ 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 a timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made an objection under provisions of Subparagraph 5.2.1.

§ 5.2.3 If the 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 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.

§ 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 or entity previously selected if the Owner or Architect objects to such change.

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

§ 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.

(Paragraph deleted)
§ 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 Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and 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 with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate contractors and the Owner in reviewing their construction schedules when directed to do so. The Contractor shall make any revisions to 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 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, 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 and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that the Owner's or separate contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

§ 6.2.3 The 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 of the Contractor. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of delays, improperly timed activities, damage to the Work or defective 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, 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 All Change Orders and Change Proposal Requests shall be based upon agreement among the Owner, Contractor and Architect; a Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor; an order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, 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 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 By mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit 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 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 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 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
(Paragraphs deleted)
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 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 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 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 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 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.

(Paragraph deleted)

§ 7.4 Minor Changes in the Work

§ 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 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, 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 an act or neglect of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner; or by changes ordered in the Work; or by fire, or other causes beyond the Contractor's control; or by delay authorized by the Owner pending mediation and 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 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)

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

§ 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:

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

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:

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

§ 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.

(Paragraph deleted)

§ 9.2 Schedule of Values

§ 9.2.1 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 for operations completed in accordance with the schedule of 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 such data substantiating the Contractor's right to payment 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 7.3.8, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Change Proposal Requests, but not yet included in Change Orders.

(Paragraph deleted)

§ 9.3.2 Payments will be made on account of materials 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 submission by the Contractor of bills of sale or such other procedures satisfactory to the Owner to establish the Owner's title to such materials or equipment or otherwise protect the Owner's interest, including applicable insurance (naming the Owner as insured) and transportation to the site for those materials and equipment. 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 and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities 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 materialmens' 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 materialmens' liens on the Work; that the Payment Application includes only Work self-performed by Contractor of 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, with a copy to the Contractor, for such amount as the Architect determines is properly due, or notify the Contractor and Owner in writing of the Architect's reasons 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 comprising the Application for Payment, that, to the best of the Architect's knowledge, information and belief, the Work has progressed to the point indicated and that the quality of the Work is in accordance with the Contract 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 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, (2) reviewed construction means, methods, techniques, 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, 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 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** persistent failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld.

(Paragraphs deleted)

§ 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 Neither the Owner nor Architect shall have an obligation to pay or to see to the payment of money to a Subcontractor except as may otherwise be required by law.

§ 9.6.5 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 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 shall entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

(Paragraph deleted)

§ 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 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 the amount certified by the 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 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 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, 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, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work 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 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 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. 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, 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 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 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 and (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner.

§ 9.10.3 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 Warrantees 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

(Paragraphs deleted)

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 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 erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and 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, 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.

§ 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.

(Paragraphs deleted)
§ 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
§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, 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 report the condition to the Owner and Architect in writing.

§ 10.3.2 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 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 such material or substance or who are to perform the task of removal or safe containment of 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.

(Paragraphs deleted)
§ 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

(Paragraph deleted)

§ 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 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 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.

(Paragraphs deleted)

§ 11.2 Owner's Liability Insurance

§ 11.2.1 The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance.

(Paragraphs deleted)

§ 11.3 Project Management Protective Liability Insurance

§ 11.3.1 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.

(Paragraphs deleted)

§ 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, 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, 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, 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, or by terms of 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 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 2.4.

§ 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.

(Paragraph deleted)

§ 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, 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

§ 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

§ 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 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. 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.

(Paragraph deleted)

§ 13.3 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.

(Paragraphs deleted)

§ 13.4 Rights and Remedies

§ 13.4.1 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.

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

(Paragraphs deleted)

§ 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 sixty (60) consecutive days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of 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 2.2.1.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of 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 constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven (7) days' written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work 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 sixty (60) consecutive Calendar Days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons 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.

§ 14.2 TERMINATION BY THE OWNER FOR CAUSE

(Paragraphs deleted)

§ 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 Contact Documents.

§ 14.2.2 When any of the 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; 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.

(Paragraph deleted)

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

(Paragraphs deleted)

ARTICLE 15 LABOR STANDARDS

(Paragraphs deleted)

§ 15.1 PREVAILING WAGE RATES

(Paragraphs deleted)

§ 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*.

(Paragraphs deleted)

§ 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.

(Paragraphs deleted)

§ 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.

(Paragraphs deleted)

§ 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.

(Paragraphs deleted)

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:	Texas Arcadis, Inc. 1330 Post Oak Blvd., Ste 2250 Houston, Texas 77056
3.	MEP Engineer:	Salas O'Brien 738 Highway 6 South, Ste. 615 Houston, Texas 77079 Phone: 281-945-8888
4.	Structural Engineer:	CJG Engineers 3200 Wilcrest Drive, Ste 305 Houston, Texas 77042 Phone: 713-780-3345
5.	Civil Engineer:	Brooks & Sparks, Inc. 21020 Park Row Dr. Katy, Texas 77449 Phone: 281-578-9595
6.	Acoustical Designer:	BAI 4006 Speedway Austin, Texas 78751 Phone: 512-476-3464
7.	Theatrical Designer:	WJHW 12175 Network Blvd., Ste 150 San Antonio, Texas 78249 Phone: 972-934-3700

8.	Geotechnical Engineer:	Terracon 1155 Clay Rd., Ste 100 Houston, Texas 77043 Phone: 713-690-8989
9.	Food Service:	Surcana FSD 15015 Fondren Rd. Missouri City, Texas 77042 Phone: 281-224-1230
10.	RAS:	Winning Way Services PO Box 750953 Houston, Texas 77252 Phone: 281-922-0700
11.	Surveying:	West Belt Surveying, Inc. 21020 Park Row Dr. Katy, Texas 77449 Phone: 281-599-8288
12.	Irrigation Designer:	Landesign Group 17041 El Camino Real, Ste 101 Houston, Texas 77058 Phone: (713) 899-8899

2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

Add the following Subparagraph:

2.2.6 The Contractor will be furnished, free of charge, **fifteen (15)** 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 1, 2022

Texas Gulf Coast Area

CLASSIFICATION	2022 HOURLY RATE
ASBESTOS WORKER	$21.13
BRICKLAYER; MASON	$25.32
CARPENTER; CASEWORKER	$23.38
CARPET LAYER; FLOOR INSTALLER	$25.12
CONCRETE FINISHER	$23.40
DATA COMM/TELE COMM	$23.50
DRYWALL INSTALLER; CEILING INSTALLER	$26.65
ELECTRICIAN	$25.93
ELEVATOR MECHANIC	$28.80
FIREPROOFING INSTALLER	$22.25
GLAZIER	$22.30
HEAVY EQUIPMENT OPERATOR	$22.40
INSULATOR	$20.50
IRONWORKER	$25.50
LABORER, HELPER	$16.71
LATHERER; PLASTERER	$23.25
LIGHT EQUIPMENT OPERATOR	$20.50
METAL BUILDING ASSEMBLER	$21.10
MILLWRIGHT	$33.63
PAINTER; WALL COVERING INSTALLER	$19.60
PIPEFITTER	$26.97
PLUMBER	$26.71
ROOFER	$20.50
SHEET METAL WORKER	$19.90
SPRINKLER FITTER	$26.13
STEEL ERECTOR	$23.25
TERRAZZO WORKER	$23.50
TILE SETTER	$19.58
WATERPROOFER; CAULKER	$19.88

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

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

SECTION 01 10 00

SUMMARY OF WORK

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

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Project, **2024 Cy Falls HS Renovation**, with campus locations at the following addresses:

- 9811 Huffmeister, Houston, Texas 77095

for the Cypress-Fairbanks Independent School District.

B. The Project(s) consists of but is not limited to:
Various renovations, program additions, mechanical/electrical/plumbing upgrades and security enhancements to an existing high school.

C. Project Schedule:

Substantial Completion dates:
1. Football Field Turf: July 15, 2025
2. Entire Scope of Work: July 26, 2026

3. General phasing requirements refer to Part 3.1.B below.

1.2 CONTRACTS AND USE OF SITE

A. Contractor Use of Premises:
1. Confine operations at site to areas permitted by law, permits, and Contract Documents, or as required to maintain campus operations (as approved by Owner).
2. Do not unreasonably encumber site with materials or equipment. Refer to Contractor lay-down areas indicated on plans. If not indicated on plans provided, Contractor to submit for approval proposed Contractor designated areas, including but not limited to: lay-down, staging, parking, restroom, trailer, dumpster, field office, etc.
3. Assume full responsibility for protection and safekeeping of products stored on premises.
4. Obtain and pay for use of additional storage or work areas as needed for operations.
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:

For the summer of 2025:

- Contractors may take over the building June 2, 2025.
- All athletic areas are to remain fully occupiable for the duration of the summer. Any work in the athletic areas will need to be coordinated with the campus. For gym work, only one gym can be under construction at any given time.
- All athletic, fine arts, dance, and cafeteria areas must be fully occupiable no later than July 15, 2025.

- The balance of the building shall be fully occupiable and turned back over to the district no later than July 27, 2025.
- Occupiable includes, but is not limited to, all life safety, MEP, architectural finishes in place, clean, and functioning as intended.
- Only work that can be removed and re-installed by these dates shall be performed during the summer.
- No partially complete work will be allowed after these dates unless approved in advance by the Owner.
- After these dates, all work shall be performed after hours, nights and weekends, while fully coordinating with the campus.

For the summer of 2026:

- Contractors may take over the building June 1, 2026.
- All athletic areas are to remain fully occupiable for the duration of the summer. Any work in the athletic areas will need to be coordinated with the campus. For gym work, only one gym can be under construction at any given time.
- All athletic, fine arts, dance, and cafeteria areas must be fully occupiable no later than July 15, 2026.
- The balance of the building shall be **SUBSTANTIALLY COMPLETE**, fully occupiable, and turned back over to the district no later than July 26, 2026.
- Occupiable includes, but is not limited to, all life safety, MEP, architectural finishes in place, clean, and functioning as intended.
- Only work that can be removed and re-installed by these dates shall be performed during the summer.
- No partially complete work will be allowed after these dates unless approved in advance by the Owner.
- After these dates, all work shall be performed after hours, nights and weekends, while fully coordinating with the campus.

Expanding Existing Voice Evac System:
Existing fire alarm system to be expanded/modified due to renovation work/scope. Existing fire alarm system to remain fully operational and monitored for the duration of the project until the areas with the new alarm system is inspected and approved by AHJ. Refer to specification and drawings.

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 Texas Arcadis, Inc. 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: Terracon
   c. Roof Inspection: Raba Kistner
   d. Mechanical Testing and Balancing: EAB
   e. Commissioning: EAB

2. Architect's Consultants:
   a. Civil Engineer: Brooks & Sparks
   b. Structural Engineer: CJD
   c. MEP Engineer: Salas O'Brien
   d. Food Service Consultant: Surcana FSD
   e. Asbestos Abatement Consultant: EFI Global, Inc.
   f. Geotechnical Engineer: Terracon, Inc.
   g. Acoustical Engineer: BAI
   h. Theatrical Consultant: WJHW
   i. Irrigation Designer: Landesign Group

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 11 26

OWNER/ARCHITECT PROVIDED DOCUMENTS

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

PART 1 - GENERAL

1.1 COPIES OF SUPPLEMENTARY CONTRACT DOCUMENTS

A. The Owner and Architect have included the following Supplementary Contract Documents for the Offerors information. The Owner and Architect **do not** guarantee the accuracy, completeness, or suitability of this information, and the Offerors should verify the existing conditions prior to the Proposal date.

1. Topographic Survey:
    1. Entitled: Cypress- Falls High School out of the Francis Fry Survey, abstract No. 268 Harris County, Texas
    2. Prepared for: Cypress- Fairbanks Independent School District
    3. Prepared by: Westbelt Surveying, Inc.
    4. Dated: July 9, 2024

2. Geotechnical Investigation Report – Refer to Section 02 32 00
    1. Entitled: CFISD Cypress Falls High School Improvements
    2. Prepared for: Arcadis
    3. Prepared by: Terracon
    4. Dated: September 25, 2025

B. The boring log from the above-mentioned soils report is included in Section 02 32 00, Geotechnical Investigation.

C. Any of the above documents bound in the drawing or specifications are included for reference purposes only.

D. Neither Architect nor Owner guarantees their contents as to accuracy, completeness, or suitability.

E. Copies may be examined at the Architect's office.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

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.

UNIT PRICE 1: ELECTRICAL DUPLEX RECEPTACLE

Provide unit price for a new 20A, 120V duplex electrical receptacle and cover plate, flush mounted in a CMU, metal stud, or demountable wall construction, circuited to an existing electrical panel within 150 feet of the outlet using a branch circuit consisting of 2 #10 AWG and 1 #10 AWG ground in 3/4-inch EMT conduit. All conduits to be concealed in wall construction. Unit price shall include a 20-amp circuit breaker to be installed in existing panel space.

UNIT PRICE 2: DATA DROP

Provide unit price for a data drop, flush mounted in a CMU, metal stud or demountable wall construction., wired to an IDF/MDF Room. The data drop shall consist of a single gang wall box, cabling wiring device, cover plate, 3/4-inch conduit from outlet to above accessible ceiling, plenum-rated cabling routed above accessible ceiling to the nearest MDF or IDF location within 250 feet of the outlet. Termination and testing to be included in the unit price.

UNIT PRICE 3: 4 ½" THICK CONCRETE WALK PER SQUARE FOOT

This unit cost shall establish the amount to the contract price for the Contractor to add or deduct 4 ½" thick concrete walk (minimum 100 SF) per Square Foot.

UNIT PRICE 4: 7" THICK CONCRETE DRIVE PER SQUARE FOOT

This unit cost shall establish the amount to the contract price for the Contractor to add or deduct 7" thick concrete drive (minimum 100 SF) per Square Foot.

UNIT PRICE 5: CHAIN LINK FENCE

This unit cost shall establish the amount to be added or deducted from the contract price for the Contractor to add/deduct chain link fence.

1.	4-foot-high fence	$_____/	linear foot
2.	4-foot-high x 3-foot-wide gate	$_____/	per leaf
3.	4-foot-high x 6-foot-wide gate	$_____/	per leaf
4.	6-foot-high fence	$_____/	linear foot
5.	6-foot-high x 3-foot-wide gate	$_____/	per leaf
6.	6-foot-high x 6-foot-wide gate	$_____/	per leaf

UNIT PRICE 6: LIFE SAFETY DEVICES (including all associated cabling and programming)

This unit cost shall establish the amount to be added or deducted from the contract price for the Contractor to add /deduct Fire Alarm devices.

1.	Exterior Horn to Speaker	$_____	each
2.	Interior Horn to Speaker	$_____	each
3.	Interior Visual Strobe	$_____	each
4.	Interior Speaker/Visual Strobe	$_____	each
5.	Smoke Detector	$_____	each
6.	Heat Detector	$_____	each
7.	Manual Pull Station	$_____	each
8.	Stopper 2 Pull Station Cover	$_____	each
9.	Annunciator Panel	$_____	each

10	Duct Detector	$_____	each
11	Relay	$_____	each
12	Supervisory	$_____	each
13	Waterflow	$_____	each
14	Amplifier	$_____	each
15	Remote Power Supply	$_____	each

UNIT PRICE 7: 4" RESILIENT BASE 100 LINEAR FEET

This unit cost shall establish the amount to be added or deducted to the contract price for the Contractor to properly remove existing base and install 4" resilient base.

UNIT PRICE 8: GRAPHIC SIGNS

This unit cost shall establish the amount to be added or deducted to the contract price for the Contractor to remove existing signage and install new as described below:

1.	Sign Type A	$_____/	each
2.	Sign Type B	$_____/	each
3.	Sign Type C	$_____/	each
4.	Sign Type D	$_____/	each
5.	Sign Type E	$_____/	each
6.	Sign Type F	$_____/	each
7.	Max Occupancy Signage	$_____/	each
8.	FDC Connection Signage	$_____/	each
9.	Wayfinding Signage (2 lines text)	$_____/	each
10.	Wayfinding Signage (3 lines text)	$_____/	Each
11.	Wayfinding Signage (4 lines text)	$_____/	each

UNIT PRICE 9: PAINTING

This unit cost shall establish the amount to be added or deducted to the contract price for the Contractor to paint 100 square feet of wall (minimum 400 square feet of wall).

UNIT PRICE 10: EXIT SIGN

This unit cost shall establish the amount to be added to the contract price to provide and install one (1) exit sign. Price shall include wiring to nearest available emergency circuit, up to 200 feet.

UNIT PRICE 11: ORNAMENTAL FENCE

This unit cost shall establish the amount to be added or deducted from the contract price for the Contractor to add/deduct ornamental fence.

1.	6-foot-high fence	$_____/	linear foot
2.	6-foot-high x 4-foot-wide gate	$_____/	per leaf

3. 6-foot-high x 6-foot-wide gate $_____/ per leaf

UNIT PRICE 12: SECURITY FILM

This unit cost shall establish the amount to be added to the contract price to provide and install security film on existing exterior glazing (minimum 200 square feet).

1. Armoured One $_____/ Square foot

UNIT PRICE 13: ACCESS CONTROL/ INTRUSTION DEVICES

This unit cost shall establish the amount to be added to the contract price to provide and install the following devices. Rough-in, power, programming, testing and termination to be included in the unit price.

1. Card Readers $_____/ Each
2. Lockdown Buttons $_____/ Each

UNIT PRICE 14: DATA INFRASTRUCTURE

Provide unit price shall establish the amount to be added to the contract price to provide and install double gang wall box, cover plate, ¾ inch conduit from outlet to above accessible ceiling, J-Box and pullstring. Cable, termination, and testing are to be furnished and installed by Owner and are not part of this price.

UNIT PRICE 15: REPLACE UNDERREAMED FOOTINGS WITH STRAIGHT SHAFT DRILLED FOOTING

This unit cost shall establish the amount to be added to the contract price to replace underreamed footings with straight shaft drilled footings.

1. 36-inch diameter $_____/ LF
2. 42-inch diameter $_____/ LF
3. 48-inch diameter $_____/ LF
4. 60-inch diameter $_____/ LF

UNIT PRICE 16: WALL SLEEVES

This unit cost shall establish the amount to be added to the contract price for the contractor to install (2) 2-inch conduit sleeves, which shall be reserved as follows.

One(1) 2-inch conduit pathway reserved for fire alarm cabling

One (1) 2-inch conduit pathway reserved for intercommunications system cabling.

Provide conduit wall sleeves for horizontal cable access into spaces, as necessary. Locate 6 inches to 8 inches above accessible ceiling. Sleeve shall extend 6 inches from wall on both sides. Provide non-split nylon bushings on ends of each sleeve. Fire stop as necessary. Adjust location as to not interfere with other conduits, lighting, plumbing, mechanical equipment, architectural feature, and building structure.

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.

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 description s 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:		Cypress-Fairbanks I.S.D.	(281) 897-4108
	1.	Name	Title	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' 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

SECTION 01 31 29

NOTIFICATION OF ARCHITECT REQUIREMENTS

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

PART 1 - GENERAL

1.1 REQUIREMENTS

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.

E. The Contractor shall use Architect's project management software - Newforma / Info Exchange to deliver and process submittals / shop drawings and requests for information (RFI).
1. The Contractor shall designate one member of his project team that will be responsible for assuring proper, timely and continuous usage of the project management software throughout the duration of the Project.
2. Contractor's personnel shall become proficient in the use of the software.
3. Contractor shall ensure usage of the project management software throughout the project.
4. In the event any Contractor key personnel are replaced or new key personnel are brought into the project team, the Contractor shall ensure the replacement personnel are trained and become proficient in the use of project management software.

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 manufactured, 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 <u>each building</u> 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.

CONTRACTOR
OVERTIME / BUILDING ACCESS REQUEST FORM
CYPRESS-FAIRBANKS INDEPENDENT SCHOOL DISTRICT

CONTRACTOR:	**CYPRESS-FAIRBANKS ISD USE ONLY:**
1. Date of Request: _____	1. Total Overtime Hours Requested: _____
2. Project: _____	2. Total Overtime Amount Due Cy-Fair ISD:
3. CFISD Project Number: _____	_____
4. Campus: _____	3. Date Submitted to Operations: _____
5. Requested Date: _____	4. Date Submitted to Security: _____
6. Requested Hours: _____ (Minimum 4 hours must be requested)	5. Date Submitted to Facilities Use: _____
7. General Contractor/Subcontractors Working and contact mobile phone numbers:	6. Comments:
_____	
_____	
8. Project Manager and Superintendent's Name and contact mobile phone numbers:	
_____	
_____	
9. Requested By: _____	

On a monthly basis and prior to contract closeout and final payment by the Owner, the Contractor hereby agrees to reimburse Cypress-Fairbanks ISD the amount of twenty two ($22.00) dollars per hour for non-normal days & weekend hours and thirty three ($33.00) dollars per hour for School District employee Holidays for the above requested overtime hours. Reimbursement will be made by separate check made payable to the Cypress-Fairbanks ISD Operations Department within thirty (30) days of invoice date. If Contractor does not work the entire time of requested overtime hours, the Contractor will still be responsible for the total requested overtime hours. With each request, Contractor will be billed 30 minutes to allow Operations to open and secure the building and also includes 30 minutes for lunch.

Acknowledged and Agreed to by: _____
Contractor's Signature Date

_____
Printed Name

Approved by: _____
CFISD Project Manager's Signature Date

_____
Printed Name

END OF SECTION

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:

Cy Falls HS shall have at least one full-time Superintendent.

Cy Falls HS 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.

F. Testing does not relieve Contractor to perform work to contract requirements.

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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
6. Section 07 52 19 - Modified Bituminous Membrane Roofing System

7. Division 23 - Mechanical (Inspection and testing of welds and bolts on mechanical piping) As requested by the Owner, Architect, or Engineer.

1.3 AUTHORITIES AND DUTIES OF THE LABORATORY

A. The inspection and testing laboratory is not authorized to revoke, alter, relax, enlarge, or release any requirement of the Specifications, or to approve or accept any portion of the Work. When it appears that the material furnished or work performed by the Contractor fails to fulfill specification requirements, the inspection and testing laboratory shall promptly notify the Owner, General Contractor, Architect, Engineers, supplier and/or subcontractor providing or preparing the materials or work being tested of such deficiencies.

B. The inspection and testing laboratory shall promptly distribute copies of the laboratory test and inspection reports. Standard distribution shall include copies of all reports to the Owner, Architect, and General Contractor. The Structural Engineer, Civil Engineer, MEP Engineer, concrete supplier, and any outside consultants shall receive copies of the testing results regarding their particular phase of the Project. Consult with Owner to determine Owner's preference of distribution (hard copy, electronic, etc.).

C. The testing laboratory shall provide testing services under a separate agreement with the Owner or Architect, who shall be responsible for the costs of initial testing – pass or fail.

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.

D. The testing lab is required to furnish a report of the status of testing performed as it relates to anticipated expenses described in the Agreement with the testing lab. Reports shall be furnished at most bi-monthly to the Owner and Architect.

1. Report information shall include verification that Owner paid testing progress corresponds with anticipated expenses.
2. The testing lab shall be required to notify the Architect and Owner immediately in writing if/when the testing lab anticipates exceeding the line item and or lump sum fee agreed by Owner.
3. Such notification must occur prior to expensing 75% of the testing lab fee.

1.4 TESTING LABORATORY GUIDELINES AND PROCEDURES

A. Technicians scheduled to perform specific inspection and testing services must be qualified to review and perform other services that overlap, i.e., earthwork, foundation inspections, rebar inspection, and concrete when scheduled concurrently at the Project site.

B. Concrete design mixes will receive a cursory review with any discrepancies reported to the Architect/Engineer. No compensation will be considered for these reviews.

C. Nuclear density testing will be based on a daily rental rate for the actual testing equipment, compensation on a per test basis will not be considered.

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/ft^3 (600 kN-m/m^3)
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.
l. 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.
      c. Place cylinders in laboratory storage, with molds removed, under moist curing conditions and temperature of 73 degrees plus or minus three (3) degrees F 24 hours after casting maintain these moist curing conditions until specimens are tested.
      d. Of the test cylinders taken per 50 cubic yards or fraction thereof, test one (1) at seven (7) days and two (2) at 28 days after casting date. Store one (1) cylinder for testing at 56 days in the event the 28 days strength tests do not meet strength requirements. Test cylinders in accordance with ASTM C39. When Type III cement is used, test at three (3) days instead of seven (7) days.

e. Each 28-day compression test report shall clearly indicate average strength results, concrete slump and air content, concrete and ambient air temperatures, and how much water was added on site by contractors as of the report date and for the class of concrete being reported.

f. Maintain a moving average for compressive strength based on the three (3) latest 28-day test results to check compliance with specification requirements. The figures for the standard deviation and moving average for strength will be kept continuously up to date and submitted on a weekly basis to the Architect and Engineer. Maintain a continuously up to date log in both graphical and tabulated form for each class of concrete.
   1) the average of the latest three (3) test results;
   2) the lowest average of three (3) consecutive test results recorded to date;
   3) the average of all sets of three (3) consecutive test results;
   4) the percentage of tests falling below specified strength;
   5) the lowest single test result.

g. Maintain a moving average for range of test results for quality control purposes as described in ACI 214, Chapter 4, Paragraphs 4.4 and 4.5. Graphical reports of moving average for range shall be submitted to the Architect and Engineer on a weekly basis.

h. Slump Tests: Conduct in accordance with ASTM C143; one (1) test shall be performed for each sampling for strength tests. Slump shall be considered acceptable if the field test is within the range of design slump plus or minus one (1) inch. For concrete placed by pumping, one (1) test shall be performed at the pump and one (1) at the point of deposit. Slump loss through pumping will be acceptable to the Architect and Engineer. Slump measured at the pump shall be evaluated for acceptance relative to the design slump in accordance with the criteria previously specified.

i. Air Content Tests: Conduct in accordance with ASTM C173; test air entrained concrete only, one (1) test shall be performed for each sampling for strength tests. Air content shall be considered acceptable if the field test is in the range of the design air content plus two (2) percent.

j. Unit Weight Tests: Conduct in accordance with ASTM C138; test each sample of lightweight concrete taken for strength tests. Unit weight shall be considered acceptable if the field test shows a fresh unit weight equal to the design unit weight plus or minus 2 pcf.

k. Chloride Tests: Perform one (1) total chloride ion test for each class of concrete placed each day. If the total chloride ion content is determined to be excessive by the Architect or Engineer, water soluble chloride ion tests shall be performed at the Contractor's expense.

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.

b. Architect's Office: One lay-out drafting table 36" x 72" x 36" high; one standard desk with three drawers; chair and drafting stool. Provide one drawing rack for 30" x 42" drawings.

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 56 39

TEMPORARY TREE AND PLANT PROTECTION

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide protection at existing trees and planted materials designated to remain on site as required to prevent damage or degradation.

C. Related Work:
   01 Section 31 15 00 – Site Clearing and Earthwork
   02 Section 31 22 19 – Finish Grading
   03 Section 31 23 33 – Trenching and Backfilling
   04 Section 31 32 13.19 – Lime Soil Stabilization

1.2 SUBMITTALS

A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed materials and assemblies to be used to protect existing trees.
   01 Shop Drawings shall indicate limits of fencing and all new work that may occur within the protection zone.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01 Include recommended cleaning products and instructions for use.
   02 Where applicable, provide recommended maintenance schedules and procedures.

F. Prior to start of Work, Contractor shall photographically document existing vegetation, plants and trees in order to capture the condition of existing vegetation, plants and trees.
   01 Such documentation shall be used at the conclusion of the Work to verify that vegetation, plants and trees are in the same condition prior to start of the Work.

1.3 QUALITY ASSURANCE

A. A pre-construction meeting shall be given to explain tree preservation and treatment during the construction process by the Architect.

B. Site preparation work shall not begin in any area where tree preservation and treatment measures have not been completed.

C. Site improvements shall be staked by the Contractor in order to facilitate location of trenching and fencing operations.

D. Any roots exposed by construction activity shall be pruned flush with the ground and covered with backfill as soon as possible. If exposed roots are not to be covered with backfill within twenty-four (24) hours, cover with a mulch or material in order to reduce soil temperature and minimize water loss due to evaporation.

E. Any work, excavation or grading required within protected root zone areas shall be limited to 3 inches cut or fill, with no roots over 3/4 inch diameter being out, and done by hand or with approved equipment and root protection.

1.4 PROJECT CONDITIONS

A. The following practices are prohibited within protection zones:
   01 Storage of construction materials, debris, or excavated material
   02 Parking vehicles or equipment
   03 Foot traffic
   04 Erection of sheds or structures
   05 Impoundment of water
   06 Excavation or other digging unless otherwise indicated
   07 Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

B. Do not direct vehicle or equipment exhaust toward protection zones.

C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 – PRODUCTS

2.1 TREE PROTECTION MATERIALS

A. Topsoil: Natural or cultivated top layer of the soil profile or manufactured topsoil; containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch (25 mm) in diameter, and free of weeds, roots, and toxic and other non-soil materials.
   01 Obtain topsoil only from well-drained sites where topsoil is 4 inches (100 mm) deep or more; do not obtain from bogs or marshes.

B. Topsoil: Complying with plant material notes as indicated on the Drawings.

C. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:
   01 Type: Pine Straw

02 Color: Natural
03 Application: Four (4) inches thick

D. Protection-Zone Fencing: Fencing fixed in position and meeting the following requirements:
01 Chain-Link Protection-Zone Fencing: Galvanized-steel fencing fabricated from minimum 2 inch (50 mm) opening, 0.148 inch (3.76 mm) diameter wire chain-link fabric; with pipe posts, minimum 2 -318 inch (60 mm) OD line posts, and 2-718 inch (73 mm) OD comer and pull posts; with 1-518 inch (42 mm) OD top trails, with 0.177 inch (4.5 mm) diameter top tension wire and 0.177 inch (4.5 mm) diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete fence system.
02 Height: 6 feet (1.8 m)
03 Gates: Single swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones; leaf width 36 inches (914 mm)

E. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes pre-punched and reinforced; legibly printed with nonfading lettering and as follows:
01 Size and Text: 18”x 24”
02 Lettering: 3 inch (75 mm) high minimum, white characters on red background

2.2 IMPLEMENTATION

A. A 24” deep x 4” wide trench shall be cut 1’-0” in from the new concrete line, lined with polyurethane plastic sheeting and backfilled. Plastic should line both sides of trench and ends of plastic should be exposed to assure proper positioning. The trench is to protect the existing root system from damage. The plastic is to restrict leaching of lime to the roots during the lime stabilization process.

B. A temporary protective fence shall be installed completely around the existing trees to remain. The location of the protective fence shall be verified with Architect. The protected area shall not be used for any reasons, including material, vehicular, and equipment storage or vehicular traffic and parking.

C. A certified Arborist shall be contracted to trim trees in the protected area, and oversee and verify that the root systems have not been damaged during the construction process. The following is a list of locally approved Arborists:
01 Champions Tree Services, Inc.
02 Davey Tree Service
03 Trees Incorporated

D. Trimming Operation:
01 The Architect and Owner shall be notified of all trimming.
02 Trees to be trimmed will include only trees affected by construction and those requiring maintenance in the preservation areas.
03 Trees to be trimmed will be designated flagged in the field.
04 Trees to be removed shall be designated by Architect.
05 A list of the trees to be trimmed and the prescribed tree treatment will be provided by the Arborist.
06 Trimming shall consist of the following methods:
a. Class IV - Crown Reduction Pruning (reference National Arborist Association Standards for Pruning of Shade Trees 1988). Special trimming procedure to reduce crown of trees up to 30 percent, to prevent impact and stress of preservation trees. Corrective pruning

and removal of all deadwood larger than 1 inch diameter will be required.

b. Removal of all vines from trees.

c. Removal of designated and or hazardous trees. All stumps shall be ground down 6 inches below grade.

d. All chips produced from the trimming operation shall be left on site for Owner's use, unless otherwise directed. Chips will be blown onto or spread over preservation areas.

07 All wood not chipped shall be hauled from site. No burning will be allowed on site.

E. Root Pruning Trenching Operation:

01 Trenching areas shall be designated and exact locations will be marked in the field.

02 Trenching depth shall be 2 foot minimum.

03 Where excavation over 3 inches in depth is to occur within the root zone area of a preserve tree, make a clean cut (a minimum of 2 feet deep) between the designated disturbed and undisturbed root zone area, with a trenching machine, in order to minimize damage to the undisturbed root zone.

04 Trench shall be backfilled and compacted immediately after trenching.

F. Tree Protection Fencing Installation:

01 Tree protection fence - the exact locations will be marked in the field by the Architect.

02 No access to fenced areas shall be permitted without prior approval by the Architect.

03 Contractor shall provide maintenance and repair of fence during site work construction.

04 Fence shall be removed after completion of site work construction, unless otherwise notified.

G. Fertilization Treatment:

01 All preservation trees shall be treated, as designated by the Architect.

02 Injection of a liquid mix of 50 percent Doggett XL Injecto feed and 50 percent "Maxicrop" into the root zone area of trees shall consist of the following method:

a. Mix one pound of "Maxicrop" per 100 gallons water with Doggett XL Injecto Feed per label instructions in tank with agitation capability.

b. Inject the mixture on a 3 foot square grid at 5 gallons per 100 square feet.

c. Injection pressure shall be 100-150 psi as soil conditions warrant.

d. Depth of injection will be 12 inches.

03 Mix approved wetting agent by label directions with mixture in order to provide better distribution and penetration of materials into soil.

H. Repair Operations:

01 If any damage to preservation trees should occur beyond what is expected during the construction period, the Architect and Arborist shall appraise the damage and order the repair by the Contractor or responsible party.

02 Trees lost due to contractor's negligence during the construction period shall be appraised by the Arborist and the Owner compensated or replacement trees provided.

2.3 REPAIR AND REPLACEMENT

A. The Contractor's photographic documentation of existing vegetation, plants and trees prior to start of Work shall be used to compare against condition vegetation, plants and

trees at the conclusion of the Work.

B. The Contractor shall repair and / or replace all existing vegetation slated to remain that have been damaged as a result of Contractor activities.

C. Such repair and / or replacement shall restore vegetation, plants and trees to their original condition prior to start of Work at no expense to the Owner.

D. Replacement of vegetation, plants and trees shall be the same species and size of the original specimen.

E. All repairs and / or replacements shall be made at no additional cost to the Owner.

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 contaminates, 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

SECTION 01 77 00

GUARANTEES, CERTIFICATES AND CLOSE-OUT

CONDITIONS OF THE CONTRACT, SUPPLEMENTARY CONDITIONS AND DIVISION I APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

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.

PART 2 - SUBSTANTIAL COMPLETION

2.1 GENERAL

A. Projects that involve phase sequential construction of major definable areas of projects that involve separate work on multiple campuses shall have Certificates of Substantial Completion issued for each phase or campus, as applicable and agreed upon by the Owner and Contractor. All conditions for Substantial Completion, including liquidated damages, shall apply for each date of Substantial Completion for each phase or campus, as applicable.

B. Individual Substantial Completion Dates for each phase or campus shall be determined and agreed upon by the Owner, Architect and Contractor. Where an Alternative Proposal dictating a required, guaranteed completion date (dates) is included in the Proposal Form and accepted by the Owner, the date(s) stated therein shall establish the Substantial Completion Dates to be incorporated into the Agreement.

C. The following items are a partial list of requirements, as applicable to the Project, which must be completed prior to establishment of a Substantial Completion date. Refer to substantial completion checklist contained within the AIA Document A201™–2017, General Conditions of the Contract for Construction as amended for a complete list.

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.

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.

C. If the Contractor fails to complete all work on the punch list within thirty (30) days after the 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 punch list items are competed and accepted by the Owner. During this time the Contractor will be charged from the Owner's, Architect's and any A/E Consultant's time associated with achieving completion of the 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.

D. Owner billable time shall be deducted from the Contractor's Final Payment or separately invoiced to the Contractor at Owner's option. Owner billable hourly rates shall be as follows:

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

E. Architect and A/E Consultant billable time shall be invoiced to the Contractor by the Architect. A/E billable rates shall be as follows:

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

PART 3– PRODUCTS

3.1 Not used.

PART 4 - CONTRACT CLOSE-OUT

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.

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4.3 WARRANTIES

A. All guarantees and warranties required by the Contract Documents shall establish the date of Substantial Completion as day one (l) 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.
   3. All as-built conditions relative to ductwork installations; shown accurately to within six (6) inches.

4. All as-built conditions relative to HVAC water piping installations; shown accurately to within six (6) inches.
5. All as-built conditions relative to underground electrical conduit installations. shown accurately to within six (6) inches.
6. Record drawings shall include a copy of fire sprinkler layout of piping and equipment.
7. All approved CPR's resulting in a physical change in the work.
8. All RFI's resulting in a physical change in the work.
9. All AEA's resulting in a physical change in the work.
10. All Minor Changes resulting in a physical change in the work.
11. All Construction Change Directives resulting in a physical change in the work.
12. Update the list of drawings as necessary to reflect added and deleted sheets.

F. All modifications shall be represented by actually deleting the original work and accurately depicting the revised as-built modifications/configurations. "X-ing out" deleted work shall not be accepted.

G. Upon completion of all revisions to the Record Drawings, including the Architect's acceptance, the Record Drawings shall be copied to a thumb drive or solid-state media drive maintaining the exact folder/file structure originally furnished to the Contractor. Submit to the Architect for review before proceeding with deliverables.

H. Deliverables: Upon Deliverables: review and acceptance of the documentation, including format, the Architect shall direct the Contractor to proceed with delivery of the following:
1. Three (3) thumb drives or solid-state media drives, containing the entire set of Record Drawings in PDF and TIFF format. Each sheet shall be a separate PDF and TIFF file. The thumb drives shall be organized to duplicate the order of drawings as they were issued for bidding and construction, with record drawing modifications.

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 lime 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.
2. The Contractor is not responsible for correcting work that has been damaged by Owner neglect or abuse, or for replacing parts due to normal wear and tear.

D. Warranty work must be completed within 10 working days unless specified otherwise. For urgent issues (e.g., life safety, HVAC, security), response times range from 4 to 6 hours.

E. For urgent warranty requests, the Contractor must maintain an answering service available 24/7, 365 days a year.

F. If the Contractor fails to complete warranty work within the specified timeframe, the Owner can complete the work and backcharge the Contractor for all related costs.

END OF SECTION

SECTION 01 91 00

GENERAL COMMISSIONING REQUIREMENTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Specifications throughout all Divisions of the Project Manual, which pertain to operable and non-operable equipment and/or building systems, are directly applicable to this Section, and this Section is directly applicable to them.

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.

1.3 DEFINITIONS

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.

C. Commissioning Authority (CxA): Party having a contractual agreement with the Owner to provide third party commissioning services as defined herein under Commissioning Authority's Role and Responsibilities. Commissioning Authority may represent the Owner and is authorized to act on behalf of the Owner. The Commissioning Authority does not have authority to alter design or installation procedures without the written approval of the Owner or the design team.

D. Contract Documents: The General Conditions, Drawings, Specifications, Addenda, and other documents developed by the A/E Team and approved by the Owner that constitute the contractual obligations of the project scope.

E. Control Point and Sensor Calibration Verification: Process of verifying the point integrity and/or sensor calibration from the physical point of monitoring (sensor, contact, actuator, etc.) to the digital point location at the Operator's interface within the respective control system (Building Automation, Lighting Controls, Power Status and Monitoring, etc.).

F. Deferred Testing: Functional Performance or Integrated System Tests performed after Substantial Completion due to partial occupancy, partial equipment acceptance, seasonal requirements, design, or other site conditions that prohibit the test from being performed prior to Substantial Completion.

G. Deficiency: Condition of a component, piece of equipment, or system that is not in compliance with the Project Documents.

H. Functional Performance Test (FPT): Test of dynamic function and operation of equipment and systems executed by the Contractor and witnessed by the CxA. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, life safety conditions, power failure, etc. Systems are operated through all specified sequences of operation. Components are verified to be responding in accordance with requirements in the Project Documents.

I. Functional Performance Testing Procedures: Commissioning protocols, detailed test procedures and instructions in tabular and script-type format that fully describe system configuration and steps required to determine if the system is performing and functioning properly.

J. Integrated Systems Test (IST): Test of dynamic function and operation of multiple systems. Integrated Systems Tests are tested under various modes, such as fire alarm and emergency situations, life safety conditions, power failure, etc. Systems are integrally operated through all specified sequences of operation. Systems and interconnections are verified to be responding in accordance with the requirements in the Project Documents.

K. Integrated Systems Testing Procedures: Commissioning protocols and detailed test procedures and instructions in tabular and script-type format that fully describe system configurations and steps required to determine if the interacting systems are performing and functioning properly.

L. Operational Testing: Activities and testing occurring after initial energizing and/or start-up of equipment that determine whether equipment is operating within the manufacturer's recommendations and the design requirements. These activities are intended to ensure that equipment and systems meet all warranty requirements and are ready for Functional Performance Testing. Common examples are Testing, Adjusting and Balancing of HVAC systems and initial load testing of electrical equipment.

M. Owner's Project Requirements (OPR): A written document that details the functional requirements of a project and the expectations of how the facility will be used and operated. These include project goals, measurable performance criteria, cost considerations, benchmarks, success criteria and supporting information.

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).

3.7.4. Contractor shall clearly list outstanding items or System Verification Checklist items not completed successfully. Contractor shall obtain from Subcontractor or vendor completed forms documenting any outstanding deficiencies within five (5) days of completion of energizing and/or start-up activities.

3.7.5. Contractor shall review completed deficiencies to determine if outstanding items prevent execution of the Functional Performance Tests and shall issue any necessary responses to the Owner and/or Commissioning Authority.

3.7.6. Contractor shall notify Owner and CxA in writing to request Functional Performance Testing of equipment and systems at least 72 hours (not including weekends or holidays) prior to the scheduled

activities. Owner may require Contractor to reschedule Functional Performance Testing to ensure availability of Owner's representative(s) as needed.

3.7.7. 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 Functional Performance Testing.

3.7.8. 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 System Verification Checklist items.

3.8. CONTROL POINT AND SENSOR CALIBRATION VERIFICATION

3.8.1. Automation systems installed on the project must be fully verified for point integrity and sensor calibration prior to Functional Performance Testing. Additional requirements for this verification are listed in other technical sections of the Specifications.

3.8.2. The Contractor shall verify these points according to the requirements in the project documents as part of start-up and operational testing of systems.

3.8.3. The TAB contractor shall independently verify each sensor and point and document the results to be included in the Final TAB Report.

3.8.4. The CxA will witness, at their discretion, this verification and/or independently verify and document the results to be included in the Final Commissioning Process Report.

3.8.5. These activities must be completed prior to the Contractor requesting Functional Performance Testing as indicated herein.

3.9. FUNCTIONAL PERFORMANCE TESTING

3.9.1. The objective of Functional Performance Testing is to demonstrate that each system operates according to the requirements in the Project Documents and meets the OPR and BOD.

3.9.2. Contractor shall operate, or cause to be operated, each system, device, or equipment item, both intermittently and continuously, for a duration period as indicated in the Specification Section(s) for each item and/or in accordance with the Project Documents, the Commissioning Plan and applicable Functional Performance Testing procedures.

3.9.3. Contractor shall operate each component device and each building system to the full extent of its capability, from minimum to maximum, and under automatic control and manual control.

3.9.4. The CxA and members of the Cx Team, including the Owner's personnel, may observe Functional 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 32 00

GEOTECHNICAL INVESTIGATION

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. The Geotechnical Investigation Report is not a part of the Contract Documents, but is included for Contractor's reference and use in determining specific scopes of work required for the complete project.

B. The Geotechnical Investigation Report specific to this project follows this Section and is identified as:

01	Entitled:	Geotechnical Engineering Report CFISD Cypress Falls High School Improvements
02	Prepared by:	Terracon Consultants, Inc.
03	Project No.:	92245329
04	Dated:	September 25,2024
05	Total Pages:	61

1.2 APPLICABILITY

A. The Geotechnical Investigation Report is provided for proposer's general information only. Architect and Owner shall not be held responsible for accuracy of data contained in the Geotechnical Report.

01 Questions or request for additional information regarding the Geotechnical Investigation Report shall be made in writing directly to the Geotechnical Lab and copied to the Architect.

B. Prior to submission of proposals, Proposers shall visit and acquaint themselves with existing conditions and make any additional investigations they deem necessary to properly propose work and satisfy themselves as to existing subsurface conditions.

01 Such investigations shall be performed only under time schedules and arrangements approved in advance by the Owner.

02 Upon making on-site observations, the Proposer shall inform the Architect of any discrepancies with the Geotechnical Investigation Report and / or any concerns the Proposer has relative to existing site conditions.

C. No additional cost will be made available to the successful proposer for work arising from his failure to examine site or subsoil conditions prior to proposing.

D. The Geotechnical Investigation Report is not a part of the Contract Documents, but is included for Contractor's reference and use in determining specific scopes of work required for the completed project.

E. A copy of the Geotechnical Investigation Report (61pages) is attached to this Section.

SEE ATTACHED REPORT

END OF SECTION

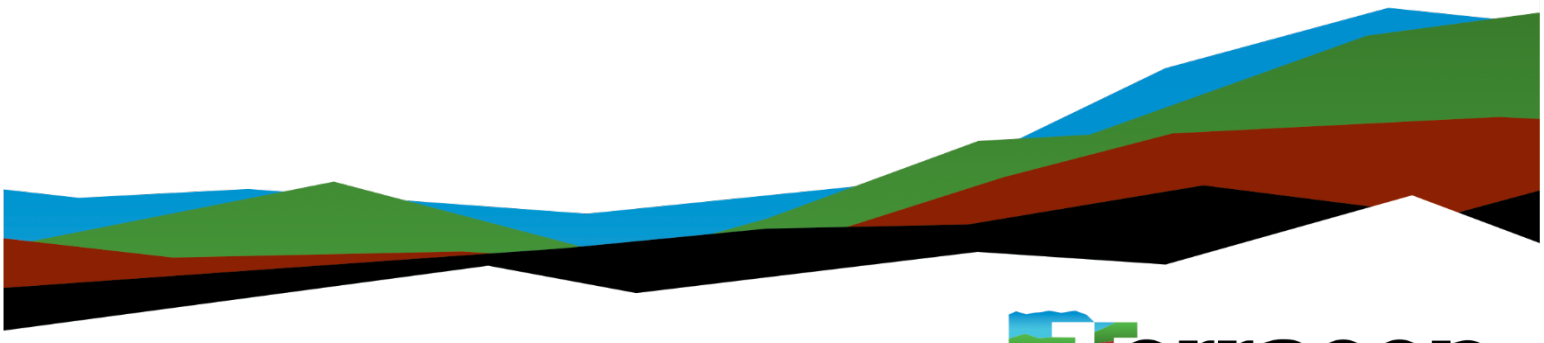
CFISD Cypress Falls High School Improvements

Geotechnical Engineering Report

September 25, 2024 | Terracon Project No. 92245329

Prepared for:

Arcadis
10205 Westheimer Road, Suite 800
Houston, Texas 77042



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September 25, 2024

Arcadis
10205 Westheimer Road, Suite 800
Houston, Texas 77042

Attn: Mr. Chudi Abajue, AIA, NCARB, LEED Green - Associate Principal
P: (281) 286-6605
E: chudi.abajue@arcadis.com

Re: Geotechnical Engineering Report
CFISD Cypress Falls High School Improvements
9811 Huffmeister Road
Houston, Texas
Terracon Project No. 92245329

Dear Mr. Abajue:

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

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

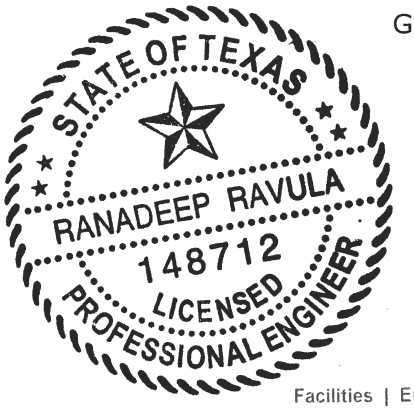
Sincerely,

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

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

Ranadeep Ravula, P.E.
Group Manager

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



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Figures

Attachments

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

Refer to each individual Attachment for a listing of contents.

Introduction

Terracon Consultants, Inc. (Terracon) is pleased to submit our geotechnical engineering report for the proposed construction of proposed improvements withing the existing Cypress Falls High School campus located at 9811 Huffmeister Road in Houston, Texas. This project was authorized by Mr. Chudi Abajue, AIA, NCARB, LEED Green - Associate Principal of Arcadis through signature of our "Agreement for Services" on July 15, 2024. This project was performed in general accordance with Terracon Document No. P92245329, dated July 11, 2024.

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

- Earthwork recommendations including site/subgrade preparation;
- Foundation design parameters and construction recommendations;
- Pavement design guidelines; and
- General subsurface information in the track item areas at locations selected by the client.

The geotechnical engineering Scope of Services for this project included the advancement of 17 test borings to depths that ranged from approximately 5 to 30 feet below existing grade.

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

Site Conditions

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

Item	Description
Project Location	The project site is located within the existing Cypress Falls High School campus located at 9811 Huffmeister Road in Houston Texas. See **Site Location**.
Existing Improvements	The site was occupied by an existing school building, tennis courts, sports fields, and associated pavements at the time of our field program.

Item	Description
Current Ground Cover	Grass, weeds, concrete pavements, and scattered trees.
Existing Topography	Relatively level.

Project Description

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

Item	Description
Proposed Improvements[1, 2]	■ A ROTC storage building addition with an approximate footprint area of 750 square feet (sf.). ■ A single-story greenhouse building with an approximate footprint area of 2,000 sf. We understand two possible locations are being considered. ■ An art classroom building addition with an approximate footprint area of 4,500 sf. ■ A new athletics storage building with an approximate footprint of 1,700 square feet. ■ Tennis courts and associated light poles. ■ Relocation of the track items, including a sand pit and shot-put area. We understand that general subsurface information at locations selected by the client is requested at this time. ■ Associated pavements.
Building Construction	Either steel-frame or concrete masonry unit (CMU) construction.
Finished floor Elevation	■ **Greenhouse and Athletics Buildings:** Approximately one to two feet. ■ **Building Additions:** Within approximately one foot above existing grade and to match the finished floor elevation to the existing building.
Maximum Loads	■ **Column loads:** 75 to 125 kips ■ **Floor slab pressure:** 125 pounds per square foot (psf)

Item	Description
Planned Foundation System	▪ **Buildings:** Drilled-and-underreamed footings ▪ **Tennis Courts:** Post-tensioned (PTI) slab-on-grade ▪ **Light Poles:** Drilled straight shafts
Pavements	We understand portions of the existing pavements are planned to be replaced with a new rigid (concrete) pavement section. We anticipate that traffic will consist primarily of passenger vehicles in the parking areas and passenger vehicles combined with garbage trucks, and large multi-axle delivery trucks and buses from time-to-time in driveway areas.

1. Based on the information provided by the client.
2. A site plan showing the layout and location of the proposed improvements were not available at the time of this report.

Geotechnical Characterization

Geology

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

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

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

The coastal plain in this region has a complex tectonic geology, several major features of which are: Gulf Coastal geosyncline, salt domes, and major sea level fluctuations during the glacial stages, subsidence and geologic faulting activities. Most of these geologic faulting activities have ceased for millions of years, but some are still active. A detailed geologic fault investigation and study of the site geology are beyond the scope of this report.

Subsurface Profile

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

Concrete pavement was observed at the ground surface at boring B-17 and was measured to be approximately 6 inches thick overlying about 6 inches of crushed stone material.

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

Model Layer	Layer Name	General Description
1	**Fill: Silty Clay**	tan, with sand pockets
2	**Fill: Sandy Lean Clay**	tan, with sand pockets
3	**Sandy Lean Clay and Silty Clay**	light gray, dark gray, and tan, very soft to hard, with sand pockets and seams and scattered roots
4	**Silt and Silty Sand**	light gray, loose to medium dense, with clay pockets
5	**Fat Clay**	light gray, stiff to very stiff, with sand pockets

Laboratory Data

A Hydrometer test was performed on one soil sample from Boring B-6 drilled in the area of the proposed tennis courts. Results of the hydrometer test is presented in the table below.

Hydrometer Analyses					
Boring No.	**Sample Depth (feet)**	**Description**	**Plasticity Index (%)**	**Percentage Fines (%)[1]**	**Percent Finer Than 2 Microns (%)[2]**
B-6	4 to 6	Sandy Lean Clay	28	64	29

Hydrometer Analyses					
Boring No.	**Sample Depth (feet)**	**Description**	**Plasticity Index (%)**	**Percentage Fines (%)[1]**	**Percent Finer Than 2 Microns (%)[2]**

1. Percent passing the No. 200 sieve.
2. Computed clay content of the soils has been used for the computation of the edge and center lift movements for the design of post-tensioned slabs-on-grade.

Groundwater Conditions

Borings B-1 through B-17 were advanced using dry drilling techniques to its termination depth (approximately 5 to 30 feet) in an effort to evaluate groundwater conditions at the time of the field program. Groundwater was initially observed at boring B-6 at a depth of approximately 24 feet during dry drilling. After a 15-minute monitoring period, groundwater was observed at boring B-6 at a depth of about 21 feet. Groundwater was not observed at Borings B-1 through B-5 and B-7 through B-17 during or upon completion of drilling.

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

Geotechnical Overview

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

- Fill soils were observed at the ground surface at borings B-10 through B-12 and extended to depths that ranged from about 2 to 4 feet. Fill soils may be present at varying depths and at other locations not explored during our field program. Support of the foundation elements, slabs, flatworks, and pavements on or above fill soils is discussed in this report. However, even with the recommended construction testing services, an inherent risk exists for the owner that compressible fill or unsuitable material within or buried by the fill will not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill.

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

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

- A foundation system consisting of drilled-and-underreamed footings may be utilized to support the proposed buildings and building additions planned at this site.

- A post-tensioned (PTI) slab-on-grade foundation system may be utilized to support the proposed tennis courts planned at this site.

- A foundation system consisting of drilled straight shafts may be utilized to support the proposed light poles planned at this site.

- A minimum 24-inch thick select fill pad should be placed under the proposed buildings and building additions to provide uniform support to the floor slabs and reduce the estimated Potential Vertical Rise (PVR) of the subgrade to approximately one inch or less.

- The PTI design parameters provided in this report are based on existing soil conditions and/or soils with similar characteristics as the on-site soils. Import fill, if planned to raise grade at the site for a post-tensioned slab-on-grade, should have similar classification, moisture content, and density as the adjacent in-situ soils and may be used provided it is free of organics and debris.

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

This summary should be used in conjunction with the entire report for design purposes. Details were not included or fully developed in this section, and the report must be read in its

entirety for a comprehensive understanding of the items contained herein. The section titled **General Comments** should be read for an understanding of the report limitations.

Earthwork

Earthwork is anticipated to include clearing and grubbing, excavations, and fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria, as necessary, to render the site in the state considered in our geotechnical engineering evaluation for foundations, floor slabs, and pavements.

Site Preparation

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

Once final subgrade elevations have been achieved, the exposed subgrade should be carefully proofrolled with a 20-ton pneumatic roller or equivalent equipment, such as a fully loaded dump truck, to detect weak zones in the subgrade. Special care should be exercised when proofrolling areas containing fill soils in an attempt to observe soft/weak zones within the fill soils. Weak areas detected during proofrolling, as well as zones of fill containing organic matter and/or debris, should be removed and replaced with soils exhibiting similar classification, moisture content, and density as the adjacent in-situ soils. Proofrolling should be performed under the direct observation of the geotechnical engineer or his/her representative.

Subsequent to proofrolling, and just prior to placement of fill, the exposed subgrade within the construction area should be evaluated for moisture and density. If the moisture and/or density do not meet the criteria described in **Fill Compaction Requirements** for on-site soils, the subgrade should be scarified to a minimum depth of 6 inches, moisture adjusted, and compacted to at least 95 percent of the Standard Effort (ASTM D 698) maximum dry density.

Fill Material Types

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

Fill Type	USCS Classification	Acceptable Location for Placement
Select Fill Soils	CL and/or SC (10≤PI≤20)	Must be used to construct the select fill pad under the floor slabs and for all grade adjustments within the structure areas.
On-site Soils[1]	Varies	■ The on-site soils, including the undocumented fill soils, appear suitable for use as fill within the pavement areas, provided they are free of organics and debris. ■ PTI structure area should be accomplished with on-site soils or exhibiting similar classification, moisture content, and density as the adjacent in-site soils provided they are free of organics and debris.

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

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

Fill Compaction Requirements

Item	Description
Fill Lift Thickness	The fill soils should be placed on prepared surfaces in lifts not to exceed 8 inches loose measure, with compacted thickness not to exceed 6 inches.

Item	Description
Compaction Requirements	■ The select fill and on-site soils should be compacted to at least 95 percent of the Standard Effort (ASTM D 698) maximum dry density. ■ The select fill soils should be moisture adjusted to within 2 percent of the optimum moisture content. ■ The on-site clay soils should be moisture conditioned to between optimum and +4 percent of the optimum moisture content.

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

Utility Trench Backfill

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

Grading and Drainage

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

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

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

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

Wet Weather/Soft Subgrade Considerations

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

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

Foundation Systems

Based on the subsurface conditions observed during our field and laboratory programs, a foundation system consisting of drilled-and-underreamed footings may be utilized to support the proposed building additions and buildings planned at this site, provided the subgrade is properly prepared as described in this report. A foundation system consisting

of a PTI slab-on-grade may be utilized to support the proposed tennis court. A foundation system consisting of drilled straight shafts may be utilized to support the proposed light poles planned at this site. Recommendations for these types of foundation systems are provided in the following sections, along with other geotechnical considerations for this project.

Design Recommendations – Drilled-and-Underreamed Footings

Item	Description
Minimum Embedment Depth [1]	10 feet below existing grade (grade at the time of our field program)
Allowable Bearing Pressures [2]	Net dead plus sustained live load – 4,000 psf Net total load – 6,000 psf
Maximum Underream-to-Shaft Diameter Ratio	3:1
Minimum Underream-to-Shaft Diameter Ratio [3]	2:1
Estimated Uplift Pressure Due to Post-Construction Heave of the Clay Soils [4]	1,000 psf
Minimum Percentage of Steel [5]	0.5 percent
Approximate Post-Construction Settlement [6]	One inch or less
Estimated Differential Settlement [7]	Approximately ½ of post-construction settlement
Allowable Passive Pressure [8]	1,000 psf
Uplift Resistance [9]	Foundation Weight (150 pcf) & Soil Weight (120 pcf)

1. The footings should bear within the native undisturbed clay soils.
2. Whichever condition yields a larger bearing area.
3. This minimum underream-to-shaft diameter ratio should result in a large enough diameter of the underream to overcome uplift forces on the footing without casing local soil failure to the overlying soils.
4. The magnitude of uplift is difficult to predict and will vary with in-situ moisture contents. This uplift pressure can be approximated over the entire perimeter of the shaft above the top of the underream.
5. The footings should contain sufficient vertical reinforcing steel throughout the entire shaft length to resist uplift (tensile) forces due to post-construction heave of the clay soils. The amount of reinforcing steel required can be computed by assuming that the dead load of the structure

Item	Description
	surcharges the footing, that the above estimated tensile force acts vertically on the shaft, and that the underream acts as a rigid anchor. 6. This estimated post-construction settlement of the drilled-and-underreamed footings is without considering the effect of stress distribution from adjacent foundations and assuming proper construction practices are being followed. A clear distance between the footings of one underream diameter of the larger footing (new and existing) should be provided between the underreams to develop the recommended bearing pressures and to control settlements. If a clearance of one diameter cannot be maintained in every case, the above bearing capacities should be reduced by 20 percent for a clearance between one half and one underream diameters. Underreams closer than a clearance of one half of an underream diameter are not recommended. 7. The differential settlement will result from variances in subsurface conditions, loading conditions and construction procedures, such a cleanliness of the bearing area or flowing water in the shaft. 8. For footings placed against an undisturbed vertical face of the in-situ soils. Lateral resistance of the drilled-and-underreamed footings is primarily developed by passive resistance of the soils against the side of the footing. Due to surface effects and the presence of expansive soils, the lateral resistance of the upper 4 feet of the soils at the surface for exterior footings should be neglected unless area paving is provided up to the edge of the building. 9. Structural uplift loads on the drilled-and-underreamed footings will be resisted by the dead weight of the footings and supported structure plus the weight of a soil wedge above the footing. The soil wedge can be assumed to extend upward from the bottom of the underream at a slope of 4 vertical to 1 horizontal.

Construction Considerations – Drilled-and-Underreamed Footings

Drilled excavations to a depth of 10 feet below existing grade will be necessary for installation of drilled-and-underreamed footings for the proposed structures planned at this site. The excavations should be performed with equipment capable of providing a relatively clean bearing area. The presence of secondary structures such as sand pockets and seams, etc., can cause sloughing during footing excavation. Thus, the drilling contractor should have casing available in the event that sloughing causes improperly formed shafts.

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

materials and/or water, and the bearing surface should be evaluated immediately prior to placing concrete.

Additionally, the subgrade soils tend to become very silty/sandy below a depth of about 13 to 18 feet below existing grade at borings B-1 through B-5. If underreams were attempted below the recommended bearing depth, they would likely become unstable. In addition, significant groundwater seepage could occur. Thus, we recommend the footing depths not be lowered below the recommended bearing depth without discussion and consideration of the consequences. The contractor should not auger the shaft deeper than the recommended bearing depth under any circumstances without contacting us.

Based on the available field and laboratory data, the underreams constructed as described in this report should remain stable for a short period of time. However, if underreams are marginally stable due to water seepage and/or the presence of sloughing soils, successful construction of underreamed footings may be possible by performing the sequence of construction without interruption, that is, each footing drilled, underreamed, and backfilled with concrete in one continuous operation. The contractor must coordinate the operation very closely to have concrete on site at the time each footing is drilled and underreamed so that no shaft or underream is drilled without concrete standing by, ready to be placed. Additional measures to reduce the potential for caving of the underream would be to limit the underream-to-shaft diameter ratio to 2.5:1 or 2:1 or to install straight shaft footings in isolated problem areas. If straight-shaft footings are planned at the site, Terracon should be contacted for additional recommendations.

Grade Beams – Drilled-and-Underreamed Footings

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

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

Design Recommendations – Post-Tensioned (PTI) Slab-on-Grade

Based on our analysis of the field and laboratory data, design parameters were computed using Addenda No. 1[1] and No. 2[2] to the 2004 Post-Tensioning Institute (PTI) method for slab-on-grade design. The moisture beneath a shallow foundation will change in response to wetting and drying conditions around the foundation perimeter. The maximum moisture variation distance is termed the edge moisture variation distance, e_m, and is an important factor governing the design of a post-tensioned floor slab. The e_m is related to percent fine clay and climatic conditions as well as other parameters, such as soil fabric factor and unsaturated diffusion coefficient.

The plasticity index of the soil, type and amount of clay mineral in the soil, and the moisture conditions from the time of construction through the life of the structure are parameters that should be considered in design of a slab-on-grade. The plasticity index and the clay mineral are values of the soil that can be estimated by laboratory tests and, although variable from location to location, remain relatively constant with time. The moisture condition has a significant effect on slab behavior and is highly variable with time, changing seasonally, with annual climate conditions, drainage patterns, ground cover, and vegetation (trees and shrubs).

Based on our laboratory test data and on our experience with similar soils, the post-tensioned slabs at this site should be designed using criteria outlined by the Post-Tensioning Institute using the following parameters:

Item	Description
Depth of Seasonal Moisture Change	Approximately 9 feet
Effective Plasticity Index	22
Percent Finer than 2 Microns [1]	29
Soil Fabric Factor	1.0
Approximate Thornthwaite Moisture Index [2]	+15
Estimated Constant Soil Suction, pF	3.5 pF
Range of Soil Suction, pF [2]	3.0 to 4.5 pF

[1]. Post-Tensioning Institute, "Addendum No. 1 to the 3rd Edition of the Design of Post-Tensioned Slabs-on-Ground", Post-Tensioning Institute, Phoenix, AZ, May 2007.
[2]. Post-Tensioning Institute, "Addendum No. 2 to the 3rd Edition of the Design of Post-Tensioned Slabs-on-Ground", Post-Tensioning Institute, Phoenix, AZ, May 2008.

Item	Description
Estimated Edge Moisture Variation Distance, e_m [3]	**For center lift**: 9.0 feet **For edge lift**: 4.7 feet
Estimated Differential Soil Movement, y_m [3]	**For center lift**: 0.7 inch **For edge lift**: 0.4 inches
Allowable Bearing Capacity [4]	**Dead load plus sustained live load**: 1,200 psf **Total net load**: 1,800 psf

1. For varying soil properties to 9 feet.
2. The differential movements were calculated by modeling the soil profile using the commercial software program VOLFLO as recommended by the PTI manual. Based on a Thornthwaite Index of +15 for this site, we considered the Post-Equilibrium Case to determine the Stress Change Factor (SCF). As recommended by the PTI manual, a suction change of 1.5 pF was used for the analysis for the Post- Equilibrium Case.
3. The estimated movements do not consider the effects of non-climatic factors which might arise from conditions beyond the control of Terracon. The conditions include, but are not limited to, location of planters and trees around the building, poor drainage, and operations of the owner/contractor on the site subsequent to our explorations.
4. Provided the subgrade is prepared as recommended in the **Earthwork** section of this report.

Post construction settlements for the slab foundation described in this subsection should be one inch or less, provided the site is prepared as described in this report. Settlement response of the foundation system is expected to be influenced more by the quality of construction and fill placement than by soil-structure interaction.

Construction Considerations – Post-Tensioned Slab-on-Grade

The excavations for slabs should be performed with equipment capable of providing a relatively clean bearing area. The bottom 6 inches of the planned foundation excavations should be performed using a smooth-mouthed excavation bucket or hand labor. The excavations should be neatly excavated and properly formed. Debris in the bottom of the excavations should be removed prior to steel placement. Water should not be allowed to infiltrate foundation excavations.

To reduce the potential for groundwater seepage into the excavations and to minimize disturbance to the bearing area, we recommend that steel and concrete be placed as soon as possible after the excavations are completed and properly cleaned. Excavations should not remain open overnight. The bearing surface of the foundation should be evaluated upon completion of the excavation and immediately prior to placing concrete.

Design Recommendations – Drilled Straight Shaft Foundations

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

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

The design parameters presented in the following table are applicable for the natural, undisturbed soils. The capacity of the upper 4 feet of the on-site soils should be disregarded due to surface effects and presence of expansive soils. Drilled straight shafts should extend at least 2 feet or half a shaft diameter, whichever is greater, into the desired bearing strata in order to use the recommended allowable end bearing pressures. The design parameters provided were calculated assuming groundwater is below 21 feet.

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

Design Parameters for Drilled Straight Shaft Footings

Below Existing Grade (feet)[1]	Effective Unit Weight (pcf)	Allowable Unit Skin Friction Resistance (psf)[3]	Allowable End Bearing Pressure (psf)[2]	Lateral Subgrade Modulus (pci)[4]		Strain ε_{50} (in/in)	Undrained Shear Strength (psf)	Angle of Internal Friction (degree)
				Static	Cyclic			
0 to 4	130	Disregard					---	---
4 to 13	130	550	Disregard	700	275	0.007	2,000	---
13 to 20	120	550	6,400	90	90	---	---	30
20 to 30	58[5]	425	3,200	60	60	---	---	28

1. Grade at the time of our field program.
2. The net allowable end bearing pressure refers to the pressure at the foundation bearing level in excess of the surrounding overburden pressure. A minimum penetration of 2 feet

Design Parameters for Drilled Straight Shaft Footings								
Below Existing Grade (feet)[1]	Effective Unit Weight (pcf)	Allowable Unit Skin Friction Resistance (psf)[3]	Allowable End Bearing Pressure (psf)[2]	Lateral Subgrade Modulus (pci)[4]		Strain ε_{50} (in/in)	Undrained Shear Strength (psf)	Angle of Internal Friction (degree)
				Static	Cyclic			

or one-half a shaft diameter, whichever is greater, into the desired bearing strata should be achieved with a minimum of 4 feet of the selected bearing stratum beneath the shaft tip to use the recommended allowable end bearing pressure.

3. The allowable side friction is based on a rectangular pressure distribution.
4. The lateral subgrade modulus values are provided for static and cyclic loading conditions. An appropriate loading condition should be selected for analysis.
5. Submerged unit weight.

Construction Considerations – Drilled Straight shafts

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

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

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

The need for casing or slurry will depend on the depth of the drilled shaft and the groundwater conditions at the time of construction. If casing is used and seepage persists,

the water accumulating in the foundation excavation should be pumped out. The condition of the bearing surface should be evaluated immediately prior to placing concrete, if casing is used in lieu of slurry. If groundwater inflow is too severe to be controlled by the use of casing and pumping or significant sloughing of the sidewalls occurs, the slurry method of construction should be utilized to complete the foundation installation.

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

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

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

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

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

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

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

Foundation Construction Monitoring

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

Connection of Building Addition to Existing Building

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

Floor Slabs

Planned finished grades for the proposed structures were not available at the time of this report. We anticipate that the finished floor elevation of the proposed building additions are planned to be within about one foot above existing grade and to match the finished floor elevation of the existing building. We anticipate that the finished floor elevation of the proposed buildings and tennis court to be within one to two feet above the existing grade. If the grading is planned to be altered from what has been previously described,

Terracon should be notified to review and/or modify our recommendations given in this subsection.

The near surface soils observed at this site generally exhibited a variable expansion potential. These soils can subject the interior floor slabs of the building to significant movements (due to shrinking and swelling) with fluctuations in their moisture content. This movement potential is influenced primarily by the properties of the subgrade soils, as well as the moisture content of the subgrade at the time of construction, overburden pressures, and the stability of the moisture contents throughout the life of the building. Based on the information developed from our field and laboratory programs and on method TEX-124-E in the Texas Department of Transportation (TxDOT) Manual of Testing Procedures, we estimate that the subgrade soils at this site exhibit a Potential Vertical Rise (PVR) of up to approximately 1½ inches. Therefore, we highly recommend that the near-surface soils be prepared as stated below to reduce the potential for slab movement associated with volumetric changes of the near-surface clay soils due to moisture variations to a more acceptable level. The actual movements could be greater if poor drainage, ponded water, and/or other sources of moisture are allowed to infiltrate beneath the structure after construction.

The most common method of subgrade preparation to reduce potential expansion of the subgrade would be to provide a pad of properly placed and compacted select fill beneath the grade-supported floor slabs. The corresponding decrease in the potential soil movements is primarily a function of the fill pad thickness and the moisture levels of the underlying clay subgrade. While the indicated preparations do not eliminate the potential for soil movement, the magnitude of such movements should be reduced to more acceptable levels. To provide uniform support to the floor slabs and to reduce the estimated PVR to approximately one inch or less, we recommend that a minimum of 24 inches of properly placed and compacted select fill material be constructed immediately beneath the floor slabs. The select fill pad should extend a minimum of 5 feet beyond the edge of the structure areas. This overbuild requirement may be omitted where the building addition is located immediately adjacent to the existing structure. The final exterior grade adjacent to the structure should be sloped to promote effective drainage away from the structure.

Select fill should be utilized for all grade adjustments within the proposed structure areas. The subgrade and select fill soils should be prepared as outlined in the **Earthwork** section of this report, which contains material and placement requirements for select fill, as well as other subgrade preparation recommendations.

The subgrade soils for flatwork outside of the structure which will be sensitive to movement should be prepared as discussed previously. This preparation will be important on surrounding sidewalks and paving immediately adjacent to the structure. If these adjacent flatwork areas are not prepared as stated above for the structure areas, the estimated PVR for these areas could approach those indicated previously for in-situ

conditions. If the soils swell in these areas, this movement could result in significant distress to the adjacent sidewalks and paving and possibly result in reversed drainage (flow of runoff toward the structure) around the perimeter of the structure.

Pavements

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

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

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

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

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

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

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

Waste dumpster areas should be constructed of at least 7 inches of reinforced concrete pavement. The concrete pad areas should be designed so that the vehicle wheels of the collection truck are supported on the concrete while the dumpster is being lifted to support the large wheel loading imposed during waste collection.

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

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

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

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

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

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

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

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

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

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

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

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

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

Lime-Flyash Treated Subgrade – The on-site soils should be treated with lime-flyash in accordance with TxDOT 2014 Standard Specifications Item 265. Based on the classification

test results, we recommend about 2 to 3 percent lime and 7 to 8 percent flyash by dry weight be used for estimating and planning. The percentages are given as application by dry weight and are typically equivalent to about 10 to 15 pounds of lime and 35 to 40 pounds of flyash per square yard per 6-inch depth. Lime-flyash is also available pre-mixed, typically in percentages of 20 to 30 percent lime and 70 to 80 percent flyash. These pre-mixed products may be used if preferred at a rate of 50 pounds per square yard per 6-inch depth. The actual quantity of lime-flyash should be determined at the time of construction based on laboratory testing conducted using bulk samples of the subgrade soils. The subgrade should be compacted to at least 95 percent of the Standard Effort (ASTM D 698) maximum dry density at a moisture content within 2 percent of the optimum moisture content.

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

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

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

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

- The subgrade and the pavement surface should be designed to promote proper surface drainage, preferably at a minimum grade of 2 percent;
- Install joint sealant and seal cracks immediately;
- Extend curbs into the treated subgrade for a depth of at least 4 inches to help reduce moisture migration into the subgrade soils beneath the pavement section; and

- Place compacted, low permeability clayey backfill against the exterior side of the curb and gutter.

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

General Comments

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

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

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

Our services and any correspondence are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third party

beneficiaries intended. Any third party access to services or correspondence is solely for information purposes only. Reliance upon the services and any work product is limited to our client, and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

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

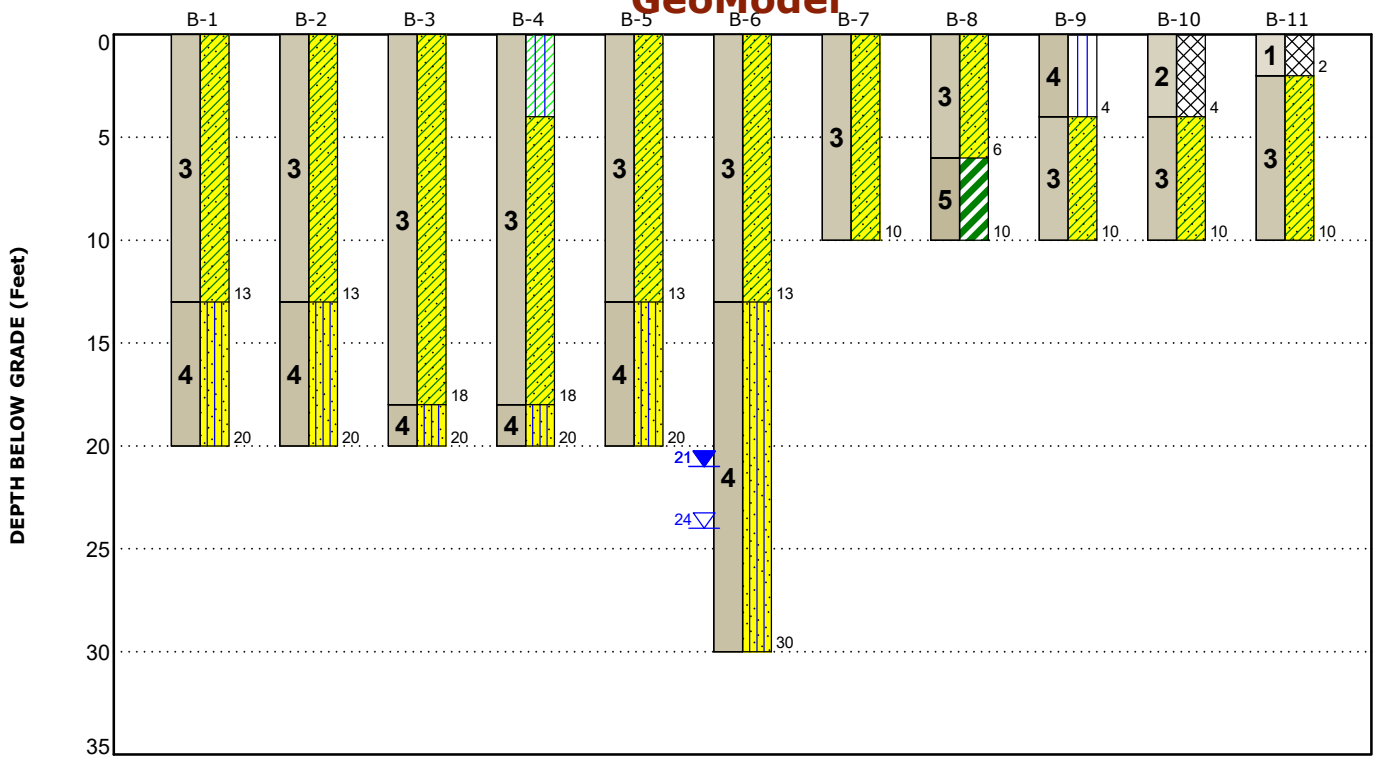
Figures

Contents:

CFISD Cypress Falls High School Improvements
9811 Huffmeister Road | Houston, Texas
Terracon Project No. 92245329

Terracon
11555 Clay Rd, Ste 100
Houston, TX

GeoModel



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

Model Layer	Layer Name	General Description
1	**Fill: Silty Clay**	tan, with sand pockets
2	**Fill: Sandy Lean Clay**	tan, with sand pockets
3	**Sandy Lean Clay and Silty Clay**	light gray, dark gray, and tan, very soft to hard, with sand pockets and seams and scattered roots
4	**Silt and Silty Sand**	light gray, loose to medium dense, with clay pockets
5	**Fat Clay**	light gray, stiff to very stiff, with sand pockets

Legend

- Sandy Lean Clay
- Silty Sand
- Silty Clay
- Fat Clay
- Silt
- Fill

▽ First Water Observation
▽ Second Water Observation
▼ Third Water Observation

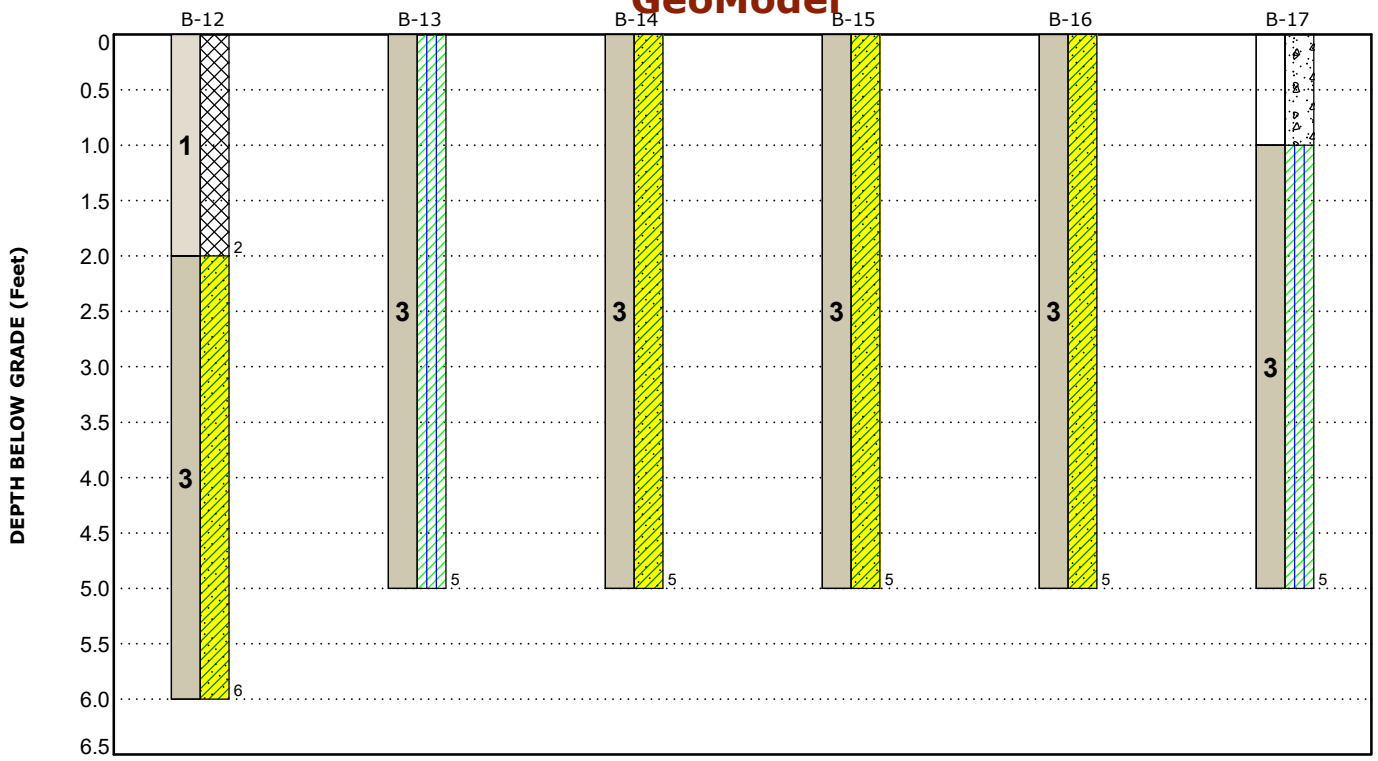
Groundwater levels are temporal. The levels shown are representative of the date and time of our exploration. Significant changes are possible over time.
Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater.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

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

CFISD Cypress Falls High School Improvements
9811 Huffmeister Road | Houston, Texas
Terracon Project No. 92245329

Terracon
11555 Clay Rd, Ste 100
Houston, TX

GeoModel



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5	**Fat Clay**	light gray, stiff to very stiff, with sand pockets

Legend

- Fill
- Sandy Lean Clay
- Silty Clay
- Pavement

▽ First Water Observation
▽ Second Water Observation
▼ Third Water Observation

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

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

Attachments

Exploration and Testing Procedures

Field Exploration

As requested, the field exploration consisted of the following:

Number of Borings	Approximate Boring Depth (feet)[1]	Location
1 (B-1)	20	Proposed ROTC building addition area
1 (B-2)	20	Proposed art room building addition area
2 (B-3 and B-4)	20	Proposed greenhouse building areas
1 (B-5)	20	Proposed athletics storage building area
1 (B-6)	30	Proposed tennis court area
5 (B-7 through B-11)	10	General subsurface information at locations selected by the client in the proposed track item areas.
3 (B-12, B-13, and B-17)	5	Proposed pavement areas

1. Below existing grade.

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

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

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

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

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

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

Property Disturbance: We augered through the existing pavement in order to access the underlying subgrade soils, as applicable. We backfilled the borings with auger cuttings and patched at the surface with ready-mixed concrete upon completion, where appropriate. Excess auger cuttings were dispersed in the general vicinity of the boring. Our services do not include repair of the site beyond backfilling our borings, and cold patching the existing pavements. Because backfill material often settles below the surface after a period, we recommend borings be periodically checked and backfilled, if necessary. We can provide this service for additional fees at your request.

Laboratory Testing

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

- ASTM D2216 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

- ASTM D7263 Standard Test Methods for Laboratory Determination of Density (Unit Weight) of Soil Specimens
- ASTM D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- ASTM D1140 Standard Test Method for Determining the Amount of Materials Finer than No. 200 Sieve in Soils by Washing
- ASTM D7928 Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation Analysis
- ASTM D2166/D2166M Standard Test Method for Unconfined Compressive Strength of Cohesive Soil

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

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

Site Location and Exploration Plans

Contents:

Site Location Plan
Exploration Plan

Note: All attachments are one page unless noted above.

Site Location

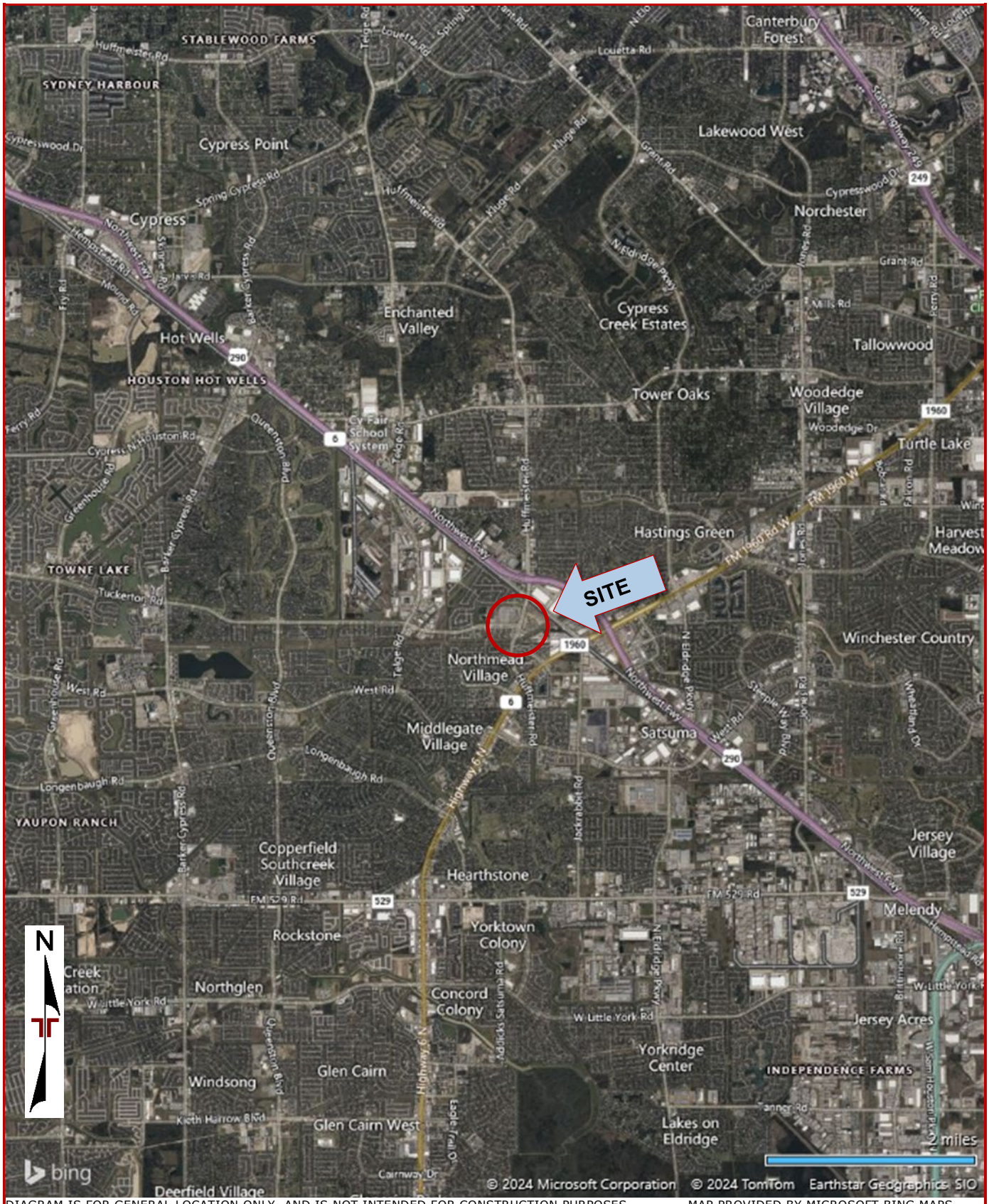

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES MAP PROVIDED BY MICROSOFT BING MAPS

Exploration Plan

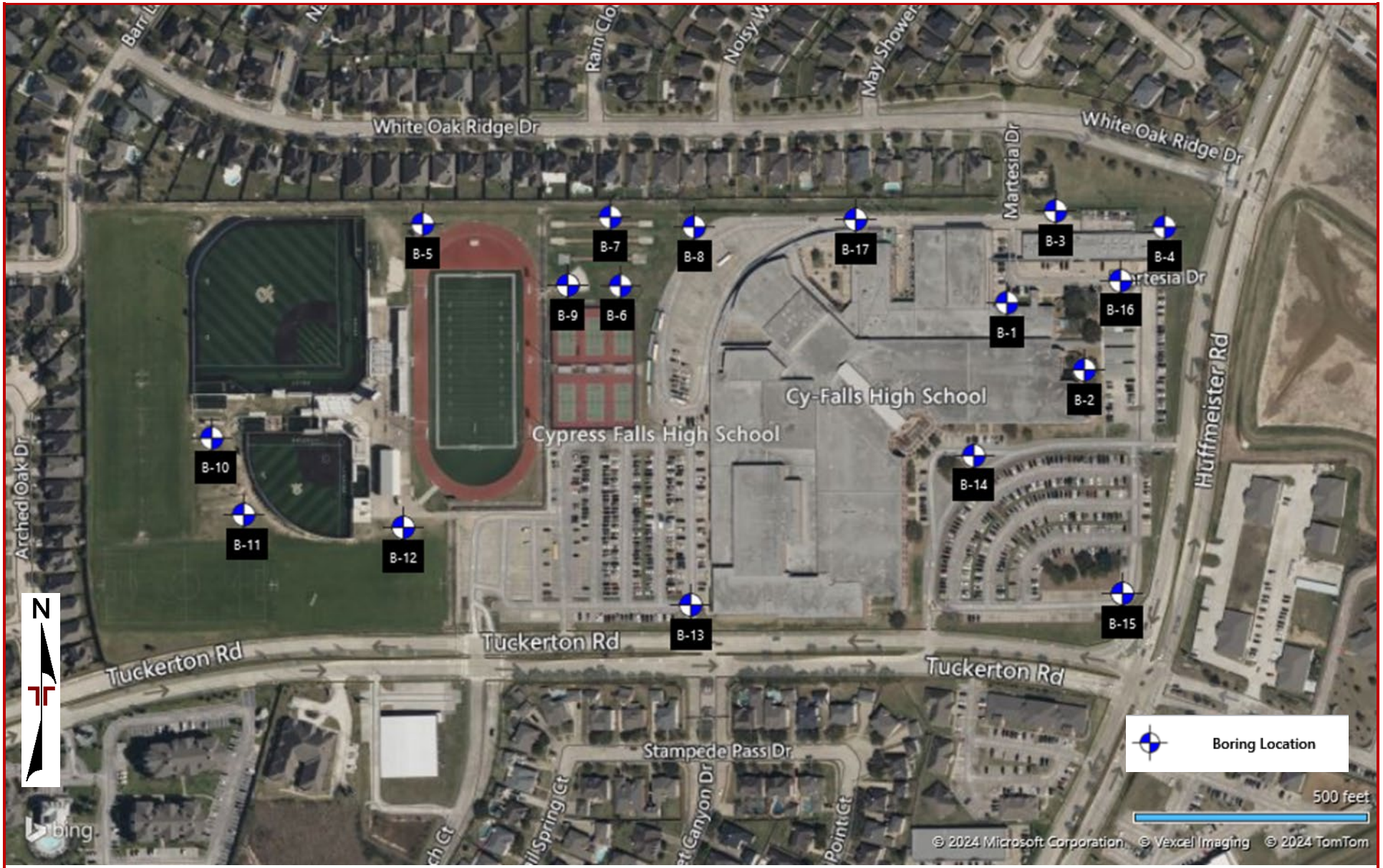

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

Exploration and Laboratory Results

Contents:

Boring Logs (B-1 through B-17)

Note: All attachments are one page unless noted above.

CFISD Cypress Falls High School Improvements
9811 Huffmeister Road | Houston, Texas
Terracon Project No. 92245329

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-1

Location: See Exploration Plan

Latitude: 29.9192° Longitude: -95.6309°

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
3		0										
					8-9-11 N=20				7.8		30-14-16	
					4.5 (HP)							
		5			4.5 (HP)				16.9		42-15-27	
					4.5 (HP)							
					4.5 (HP)				11.7			56
		10			4.5 (HP)	UC	2.40	4.4	13.1	121		
4					8-10-10 N=20							
		15										
					7-11-12 N=23							
		20										

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

- tan, with sand seams 6 to 13 feet

13.0

SILTY SAND (SM), light gray, medium dense

20.0

Boring Terminated at 20 Feet

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

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed.

Drill Rig
Truck

Hammer Type
Automatic

Driller
Herman Drilling

Logged by
J. Grimes

Boring Started
08-24-2024

Boring Completed
08-24-2024

Notes

Advancement Method
Dry augered to 20 feet.

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-2

Location: See Exploration Plan

Latitude: 29.9189° Longitude: -95.6304°

Model Layer	Graphic Log	Depth (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
3			**SANDY LEAN CLAY (CL)**, dark gray, very stiff to hard, with sand pockets			18-21-34 N=55							
			- tan 2 to 13 feet			4.5 (HP)				6.1		31-14-17	
		5				4.5 (HP)							
						4.5 (HP)	UC	5.77	3.3	9.5	119	26-15-11	
			- with sand seams 8 to 13 feet			4.5 (HP)							
		10				4.5 (HP)							
			13.0										
4			**SILTY SAND (SM)**, light gray, medium dense			10-13-13 N=26							
		15											
						9-11-13 N=24							
		20	20.0										
			Boring Terminated at 20 Feet										

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

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed.

Drill Rig
Truck

Hammer Type
Automatic

Driller
Herman Drilling

Logged by
J. Grimes

Boring Started
08-24-2024

Boring Completed
08-24-2024

Notes

Advancement Method
Dry augered to 20 feet.

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-3

Location: See Exploration Plan

Latitude: 29.9198° Longitude: -95.6306°

Model Layer	Graphic Log	Depth (Ft.)	Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
3			**SANDY LEAN CLAY (CL)**, dark gray, stiff to very stiff, with sand pockets				2.0 (HP)				23.5		47-17-30	
							2.5 (HP)							
				5			4.5 (HP)				27.8		45-15-30	
			- tan 6 to 18 feet				4.5 (HP)							
							4.5 (HP)	UC	2.19	4.6	14.9	118		
				10			4.5 (HP)							
							2.5 (HP)							
				15										
		18.0												
4			**SILTY SAND (SM)**, light gray, medium dense				3-5-7 N=12							
		20.0		20										
			Boring Terminated at 20 Feet											

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

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed.

Drill Rig
Truck

Hammer Type
Automatic

Driller
Herman Drilling

Logged by
J. Grimes

Boring Started
08-24-2024

Boring Completed
08-24-2024

Notes

Advancement Method
Dry augered to 20 feet.

Abandonment Method
Boring backfilled with auger cuttings upon completion.

CFISD Cypress Falls High School Improvements
9811 Huffmeister Road | Houston, Texas
Terracon Project No. 92245329

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-4

Location: See Exploration Plan

Latitude: 29.9197° Longitude: -95.6298°

Model Layer	Depth (Ft.)	Material Description	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
3	0	**SILTY CLAY (CL-ML)**, dark gray, very stiff, with sand pockets - with scattered roots 0 to 2 feet		6-8-8 N=16							
	4.0			5-8-9 N=17				11.4		19-14-5	
	5	**SANDY LEAN CLAY (CL)**, dark gray and tan, stiff to very stiff, with sand pockets		2.5 (HP)							
		- light gray 6 to 18 feet		3.5 (HP)				14.1		37-14-23	
				4.0 (HP)							
	10			2.5 (HP)	UC	1.78	9.6	15.7	118		66
				3.0 (HP)							
	15										
	18.0										
4		**SILTY SAND (SM)**, light gray, medium dense		5-6-6 N=12							
	20.0										
	20	***Boring Terminated at 20 Feet***									

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

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed.

Drill Rig
Truck

Hammer Type
Automatic

Driller
Herman Drilling

Logged by
J. Grimes

Boring Started
08-24-2024

Boring Completed
08-24-2024

Notes

Advancement Method
Dry augered to 20 feet.

Abandonment Method
Boring backfilled with auger cuttings upon completion.

CFISD Cypress Falls High School Improvements
9811 Huffmeister Road | Houston, Texas
Terracon Project No. 92245329

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-5

Location: See Exploration Plan

Latitude: 29.9197° Longitude: -95.6348°

Model Layer	Graphic Log	Depth (Ft.)	Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
3			**SANDY LEAN CLAY (CL)**, gray and tan, soft to very stiff, with sand pockets				10-8-7 N=15				4.8		22-13-9	
							2-2-2 N=4							
				5			4.5 (HP)	UC	3.88	4.2	14.3	118	49-15-34	
							4.5 (HP)							
							4.5 (HP)							
				10			4.0 (HP)							
		13.0												
4			**SILTY SAND (SM)**, light gray, medium dense				5-6-7 N=13							
				15										
		20.0					5-6-8 N=14							
			Boring Terminated at 20 Feet	20										

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

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed.

Drill Rig
ATV

Hammer Type
Automatic

Driller
Terracon

Logged by
C. Keeth

Boring Started
08-13-2024

Boring Completed
08-13-2024

Notes

Advancement Method
Dry augered to 20 feet.

Abandonment Method
Boring backfilled with auger cuttings upon completion.

CFISD Cypress Falls High School Improvements
9811 Huffmeister Road | Houston, Texas
Terracon Project No. 92245329

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-6

Location: See Exploration Plan

Latitude: 29.9193° Longitude: -95.6335°

Model Layer	Graphic Log	Depth (Ft.)	Material Description	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
3		0	**SANDY LEAN CLAY (CL)**, dark gray, very soft to very stiff, with sand pockets	0			5-12-10 N=22							
							3-2-1 N=3				16.0		36-16-20	
		5		5			4.5 (HP)	UC	2.39	6	14.7	117		64
			- light gray and tan 6 to 13 feet				4.5 (HP)				14.3		44-16-28	
							4.0 (HP)							
		10		10			4.0 (HP)	UC	2.22	13.3	15.8	117		
		13.0												
4			**SILTY SAND (SM)**, light gray, loose to medium dense	15			5-7-9 N=16							
				20	▼		6-7-10 N=17							
				25	▽		2-3-5 N=8							
				30			2-3-6 N=9							
		30.0	***Boring Terminated at 30 Feet***											

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

See Supporting Information for explanation of symbols and abbreviations.

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

Notes
Percent finer than 2 microns at 4 to 6 feet is 29 percent.

Advancement Method
Dry augered to 30 feet.

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
ATV

Hammer Type
Automatic

Driller
Terracon

Logged by
C. Keeth

Boring Started
08-13-2024

Boring Completed
08-13-2024

CFISD Cypress Falls High School Improvements
9811 Huffmeister Road | Houston, Texas
Terracon Project No. 92245329

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-7

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 29.9197° Longitude: -95.6336° Depth (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
3		**SANDY LEAN CLAY (CL)**, tan, medium stiff to very stiff, with sand pockets				4-5-5 N=10				9.2		26-14-12	
						2-3-3 N=6							
			5			4.5 (HP)				14.5		47-15-32	
						4.5 (HP)							
						4.5 (HP)							
		10.0	10										
		Boring Terminated at 10 Feet											

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

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed.

Drill Rig
ATV

Hammer Type
Automatic

Driller
Terracon

Logged by
C. Keeth

Boring Started
08-13-2024

Boring Completed
08-13-2024

Notes

Advancement Method
Dry augered to 10 feet.

Abandonment Method
Boring backfilled with auger cuttings upon completion.

CFISD Cypress Falls High School Improvements
9811 Huffmeister Road | Houston, Texas
Terracon Project No. 92245329

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-8

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 29.9197° Longitude: -95.6331° Depth (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
3		**SANDY LEAN CLAY (CL)**, gray, medium stiff to very stiff, with sand pockets				0-6-10 N=16							
		- tan 2 to 6 feet				12-9-5 N=14				14.7		27-15-12	
			5			3-3-4 N=7							
5		**FAT CLAY (CH)**, light gray, stiff to very stiff, with sand pockets				3.0 (HP)				16.1		51-16-35	
		10.0				1.5 (HP)							
		Boring Terminated at 10 Feet	10										

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

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed.

Drill Rig
ATV

Hammer Type
Automatic

Driller
Terracon

Logged by
K. Chavez

Boring Started
08-09-2024

Boring Completed
08-09-2024

Notes

Advancement Method
Dry augered to 10 feet.

Abandonment Method
Boring backfilled with auger cuttings upon completion.

CFISD Cypress Falls High School Improvements
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Terracon Project No. 92245329

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-9

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 29.9193° Longitude: -95.6339° Depth (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
4		**SILT (ML)**, dark gray, loose, with clay pockets								10.1		15-14-1	
		4.0				5-5-2 N=7							
3		**SANDY LEAN CLAY (CL)**, tan, very stiff, with sand pockets	5			2.5 (HP)							
						4.5 (HP)							
		10.0				4.5 (HP)							
		Boring Terminated at 10 Feet	10										

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

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed.

Drill Rig
ATV

Hammer Type
Automatic

Driller
Terracon

Logged by
C. Keeth

Boring Started
08-13-2024

Boring Completed
08-13-2024

Notes

Advancement Method
Dry augered to 10 feet.

Abandonment Method
Boring backfilled with auger cuttings upon completion.

CFISD Cypress Falls High School Improvements
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Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-10

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 29.9185° Longitude: -95.6363° Depth (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
2		**FILL - SANDY LEAN CLAY (CL)**, tan, with sand pockets				7-6-10 N=16							
						9-8-10 N=18				9.8		34-15-19	
		4.0	5			4.5 (HP)							
3		**SANDY LEAN CLAY (CL)**, gray, very stiff, with sand pockets - light gray and tan below 6 feet				7-7-9 N=16				9.5		39-15-24	
		10.0				3.0 (HP)							
		Boring Terminated at 10 Feet	10										

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

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed.

Drill Rig
ATV

Hammer Type
Automatic

Driller
Terracon

Logged by
K. Chavez

Boring Started
08-09-2024

Boring Completed
08-09-2024

Notes

Advancement Method
Dry augered to 10 feet.

Abandonment Method
Boring backfilled with auger cuttings upon completion.

CFISD Cypress Falls High School Improvements
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Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-11

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 29.9180° Longitude: -95.6361° Depth (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1		**FILL - SILTY CLAY (CL-ML)**, tan, with sand pockets 2.0				4-8-6 N=14				9.5		22-15-7	
3		**SANDY LEAN CLAY (CL)**, dark gray, very stiff, with sand pockets - tan 4 to 6 feet - light gray below 6 feet 10.0	5			4.5 (HP) 8-9-11 N=20 4.5 (HP) 4.5 (HP)				7.7		45-15-30	
		Boring Terminated at 10 Feet	10										

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

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed.

Drill Rig
ATV

Hammer Type
Automatic

Driller
Terracon

Logged by
K. Chavez

Boring Started
08-09-2024

Boring Completed
08-09-2024

Notes

Advancement Method
Dry augered to 10 feet.

Abandonment Method
Boring backfilled with auger cuttings upon completion.

CFISD Cypress Falls High School Improvements
9811 Huffmeister Road | Houston, Texas
Terracon Project No. 92245329

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-12

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 29.9179° Longitude: -95.6350° Depth (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1		**FILL - SILTY CLAY (CL-ML)**, tan, with sand pockets				10-38-41 N=79				3.9		19-14-5	
		2.0											
3		**SANDY LEAN CLAY (CL)**, tan, very stiff				6-8-8 N=16							
			5			5-7-9 N=16							
		6.0											
		Boring Terminated at 6 Feet											

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

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed.

Drill Rig
ATV

Hammer Type
Automatic

Driller
Terracon

Logged by
K. Chavez

Boring Started
08-09-2024

Boring Completed
08-09-2024

Notes

Advancement Method
Dry augered to 6 feet.

Abandonment Method
Boring backfilled with auger cuttings upon completion.

CFISD Cypress Falls High School Improvements
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Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-13

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 29.9175° Longitude: -95.6330° Depth (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
3		**SILTY CLAY (CL-ML)**, gray, very stiff, with sand pockets				2.5 (HP)				13.9		22-15-7	
						2.5 (HP)							
		- light gray and tan below 4 feet 5.0				4.0 (HP)							
		Boring Terminated at 5 Feet	5										

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

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed.

Drill Rig
Truck

Driller
Herman Drilling

Logged by
J. Grimes

Boring Started
08-24-2024

Boring Completed
08-24-2024

Notes

Advancement Method
Dry augered to 5 feet.

Abandonment Method
Boring backfilled with auger cuttings upon completion.

CFISD Cypress Falls High School Improvements
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Terracon
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Houston, TX

Boring Log No. B-14

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 29.9183° Longitude: -95.6312° Depth (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
3		**SANDY LEAN CLAY (CL)**, gray, with sand pockets								19.9		23-14-9	
		5.0	5										
		Boring Terminated at 5 Feet											

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

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed.

Drill Rig
Hand Auger

Driller
Terracon

Logged by
M. Johnson

Boring Started
09-23-2024

Boring Completed
09-23-2024

Notes

Advancement Method
Dry augered to 5 feet.

Abandonment Method
Boring backfilled with auger cuttings upon completion.

CFISD Cypress Falls High School Improvements
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Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-15

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 29.9176° Longitude: -95.6302° Depth (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
3		**SANDY LEAN CLAY (CL)**, gray, with sand pockets											
										21.2		30-14-16	
		5.0	5										
		Boring Terminated at 5 Feet											

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

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed.

Drill Rig
Hand Auger

Driller
Terracon

Logged by
M. Johnson

Boring Started
09-23-2024

Boring Completed
09-23-2024

Notes

Advancement Method
Dry augered to 5 feet.

Abandonment Method
Boring backfilled with auger cuttings upon completion.

CFISD Cypress Falls High School Improvements
9811 Huffmeister Road | Houston, Texas
Terracon Project No. 92245329

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-16

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 29.9193° Longitude: -95.6299° Depth (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
3		**SANDY LEAN CLAY (CL)**, gray, with sand pockets								9.2		24-14-10	
		5.0	5										
		Boring Terminated at 5 Feet											

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

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed.

Drill Rig
Hand Auger

Driller
Terracon

Logged by
M. Johnson

Boring Started
09-23-2024

Boring Completed
09-23-2024

Notes

Advancement Method
Dry augered to 5 feet.

Abandonment Method
Boring backfilled with auger cuttings upon completion.

CFISD Cypress Falls High School Improvements
9811 Huffmeister Road | Houston, Texas
Terracon Project No. 92245329

Terracon
11555 Clay Rd, Ste 100
Houston, TX

Boring Log No. B-17

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 29.9197° Longitude: -95.6319° Depth (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
		1.0 **PAVEMENT**, Appoximately 6 inches of concrete overlying about 6 inches of crushed stone material											
3		**SILTY CLAY (CL-ML)**, gray, stiff to very stiff, with sand pockets				2.0 (HP)				12.7		20-14-6	
						3.0 (HP)							
		5.0				4.0 (HP)							
		Boring Terminated at 5 Feet	5										

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

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed.

Drill Rig
Truck

Driller
Herman Drilling

Logged by
J. Grimes

Boring Started
08-24-2024

Boring Completed
08-24-2024

Notes

Advancement Method
Dry augered to 5 feet.

Abandonment Method
Boring backfilled with auger cuttings and patched with ready-mixed concerte upon completion.

Supporting Information

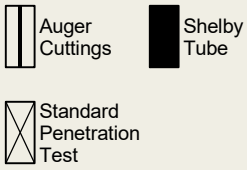
Contents:

Note: All attachments are one page unless noted above.

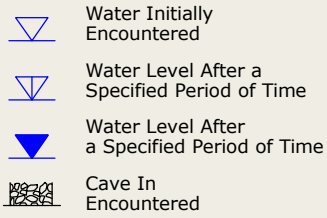
Terracon
11555 Clay Rd, Ste 100
Houston, TX

General Notes

Sampling



Water Level



Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

Field Tests

N	Standard Penetration Test Resistance (Blows/Ft.)
(HP)	Hand Penetrometer
(T)	Torvane
(DCP)	Dynamic Cone Penetrometer
UC	Unconfined Compressive Strength
(PID)	Photo-Ionization Detector
(OVA)	Organic Vapor Analyzer

Descriptive Soil Classification

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

Location And Elevation Notes

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

Strength Terms

Relative Density of Coarse-Grained Soils
(More than 50% retained on No. 200 sieve.)
Density determined by Standard Penetration Resistance

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

Consistency of Fine-Grained Soils
(50% or more passing the No. 200 sieve.)
Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance

Consistency	Unconfined Compressive Strength Qu (tsf)	Standard Penetration or N-Value (Blows/Ft.)
Very Soft	less than 0.25	0 - 1
Soft	0.25 to 0.50	2 - 4
Medium Stiff	0.50 to 1.00	4 - 8
Stiff	1.00 to 2.00	8 - 15
Very Stiff	2.00 to 4.00	15 - 30
Hard	> 4.00	> 30

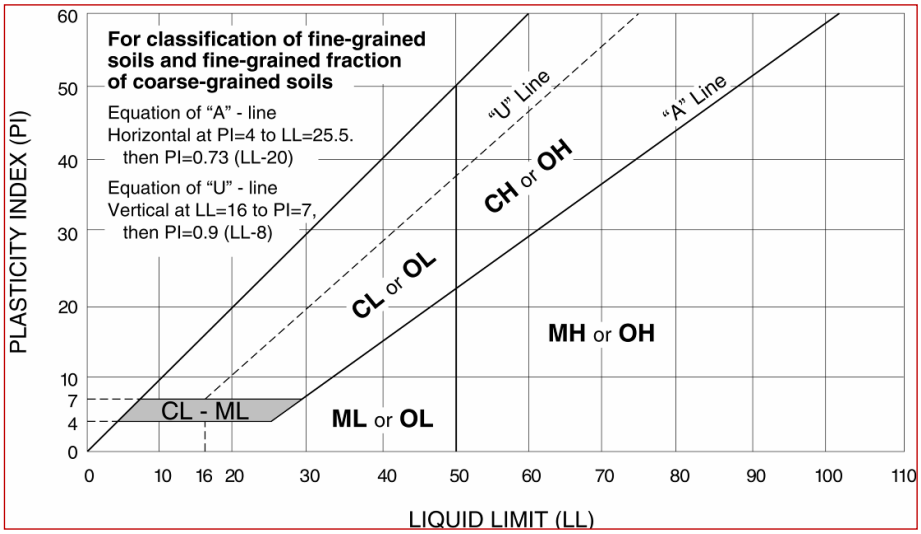
Relevance of Exploration and Laboratory Test Results

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

Unified Soil Classification System

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

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



SECTION 02 41 19

SELECTIVE DEMOLITION

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 – GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Complete all demolition work as shown on the Drawings, specified herein and required for the proper installation and interface of new work.
   02 The Drawings depict general demolition requirements based on existing drawings and limited field observations; but are not exhaustive.
   03 Visit the site and examine the existing conditions. Note all conditions as to character and extent of work involved.
   04 Contractor performing this work shall include in the proposal what is necessary to provide required demolition based on experience and industry standards.

C. Related Work:
   01 Section 01 56 39 – Temporary Tree & Plant Protection
   02 Section 02 82 13 – Asbestos Abatement
   03 Section 31 15 00 – Site Clearing and Earthwork

1.2 PERMITS AND ORDINANCES

A. Procure and pay for all necessary permits or certificates required to complete the Work specified. Make any and all required notifications and comply with all applicable Federal, State and Local ordinances.

B. Strictly adhere to all governing authorities' ordinances for proper disposal of all materials removed from the site.

PART 2 – MATERIALS

2.1 GENERAL

A. Materials and equipment used for demolition work section shall be in accordance with industry standards and specifically suited for the task at hand.

B. Where partial existing work is removed, and the remaining portion is designed to interface with new work, carefully cut or otherwise remove existing work as required for proper fit and finish to subsequent new work.

C. All existing concrete to be removed shall be saw-cut as required to provide a smooth, vertical edge to tie into new adjacent concrete.

D. All existing masonry to be removed shall be saw-cut as required to provide a smooth, vertical edge to tie into new adjacent masonry or other work as indicated on the Drawings.

E. All abandoned water and sewer lines shall be removed back to a concealed location and capped.
   01 At Slab Conditions: below slab. Cut and patch as required.
   02 At Drywall Partitions: behind gyp board panel. Cut and patch as required.
   03 At CMU Walls: behind CMU or back to CMU cavity where pipe runs in cavity. Cut and patch as required.
   04 At Ceiling Conditions: to above finished ceiling panel. Cut and patch as required.

F. Field verify existing conditions and coordinate with other trades as required to include the full scope of work required.

PART 3 - EXECUTION

3.1 PROTECTIONS

A. Prior to start of demolition work, Contractor shall provide Architect with comprehensive video documentation of existing work within and adjacent to the areas of demolition.
   01 Such documentation shall be used to evaluate existing work to remain to determine if any consequential / collateral damage has occurred as a result of demolition activities.
   02 Contractor shall make all necessary repairs and / or replacements at such damage as required to restore to original condition.

B. Execute all demolition work in an orderly and careful manner with due consideration for any existing structures, including any part of the surrounding areas which are to remain.
   01 Barricade and cover as necessary to protect work to remain and adjacent areas.
   02 Protect any existing active service lines, indicated or not.
   03 Provide adequate protective covering to assure that no damage occurs to existing areas / work to remain.

C. Avoid any encroachment on adjacent properties and Right-Of-Ways. Repair and make good any damage to adjoining properties or improvements caused by operations, including any damage or loss to adjoining materials.

D. Keep all pedestrian areas clear for passage at all times.

E. Conduct operations so as not to interfere with adjacent roads, streets, drives, walks, service lines and the like.

3.2 GENERAL

A. Coordinate with other trades as required to confirm extent of demolition to be performed.
   01 Where over-demolition occurs, or work is removed that should have remained, make all necessary repairs and / or replacements required to

restore existing work.

B. Backfill any trenches caused by demolition work. Refer to Section 31 23 33 – Trenching and Backfilling.

C. Salvage of Removed Material:
   01 The Owner reserves the right to claim all material / equipment removed under this Contract.
   02 Prior to the start of demolition work, the Contractor shall contact the Owner to determine what, if any, materials and / or equipment removed are to be salvaged for Owner's retention.

D. Disposition of Removed Material: All material removed under this Contract, which is not to be salvaged or reused, shall become the property of the Contractor and be promptly removed from the site. Do not store or permit debris to accumulate on the site.

E. The Contractor shall review the Contract Documents as they relate to selective demolition. Items that will interfere with new work shall be removed as required to coordinate with the new work.

F. Clean-Up: On completion of demolition work, leave property and adjacent areas clean and satisfactory to local authorities and the Architect.

3.3 EXECUTION

A. All partial demolition at existing concrete work shall be performed by saw-cutting or removal back to a full-depth concrete joint; as required to provide a clean interface with new concrete tying into existing concrete work to remain.

B. At areas of partial demolition, where remaining existing work is to tie into new work, conduct demolition as required to provide proper interface between existing work to remain and new work.

C. Where existing work is shown to be removed and re-used (i.e. masonry), carefully remove such work and preserve in a condition suitable for reinstallation.

END OF SECTION

SECTION 03 15 19

BELOW SLAB VAPOR MEMBRANES

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide all vapor retarder membranes, vapor barrier membranes and related accessories as required forming a complete, 100% sealed membrane below building foundations.
   02 Coordinate Work with other trades to seal all penetrations through the slab membrane.

C. Related Work:
   01 Section 01 45 29 – Inspection Testing Lab
   02 Section 03 30 00 – Cast-In-Place Concrete

1.2 SUBMITTALS

A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.
   03 Installation shall be in strict accordance with ASTM E1643.
   04 Provide details to be used to seal the perimeter of the vapor barriers to the foundation per ASTM E1642-11.
   05 Provide details to be used to seal other trade work that penetrates the slab membrane.
   06 Provide details to be used to seal penetrations made by temporary form stakes.

E. Tests and Certifications:

01 Summary of test results per paragraph 9.3 of ASTM E1745.
02 All mandatory ASTM E1745 testing must be performed on a single production roll per ASTM E1745 Section 8.1.
03 Upon completion of slab membrane installation and foundation preparation immediately prior to placement of concrete, manufacturer's rep shall inspect membrane installation and provide certification that installation is complete, and in accordance with specified requirements.

F. Actual Samples of Proposed Materials:
01 Vapor retarder membrane, 8" x 10" minimum size.
02 Vapor barrier membrane, 8" x 10" minimum size.
03 Membrane perimeter grade beam sealing device(s).
04 Joint / seam tape, 12" minimum length.
05 Pre-formed penetration boot (each type).

1.3 REFERENCES

A. American Concrete Institute (ACI):
01 Detailing Manual.
02 ACI 302.2R-06 – Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

B. U.S. Federal Specifications:
01 Fed. Spec. SS-S-158.
02 Fed. Spec. SS-S-164.

C. American Society for Testing and Materials (ASTM):
01 ASTM D882 – Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
02 ASTM D1709 – Standard Test Methods for Impact Resistance of Plastic Film by the Free Falling Dart Method.
03 ASTM E154 – Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
04 ASTM E1643 – Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
05 ASTM E1745 Class A – Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

1.4 SITE CONDITIONS

A. Do not proceed with membrane installation until all subgrade testing is complete and found to be in compliance with specified requirements.

B. Subgrade Conditions:
01 Inspect subgrade conditions as required to confirm adequacy for installation of slab membrane work in accordance with manufacturer's standards and specified requirements.
02 Verify that under-slab work of other trades is complete and does not present any conditions that may prevent the proper installation of slab membrane work in accordance with manufacturer's standards and specified requirements; or create a potential for breaching the membrane after it is installed.
03 Notify Contractor of any discrepancies, deficiencies and / or issues. Do not proceed until fully resolved.

PART 2 - PRODUCTS

2.1 MANUFACTURERS – VAPOR RETARDER MEMBRANES

A. Under Slab Vapor Retarder Membrane: Design is based on products / systems manufactured by Stego Industries.

B. Other acceptable manufacturers: the following manufacturers are acceptable provided proposed products meet or exceed all specified requirements.
   01 Reef Industries.
   02 Sundance, Inc.

2.2 MANUFACTURERS – VAPOR BARRIER MEMBRANES

A. Under Slab Vapor Barrier Membrane: Design is based on products / systems manufactured by Stego Industries.

B. Other acceptable manufacturers: the following manufacturers are acceptable provided proposed products meet or exceed all specified requirements.
   01 Reef Industries.
   02 Sundance, Inc.

2.3 VAPOR RETARDER BELOW-SLAB MEMBRANES

A. Design of Vapor Retarder Membrane is based on Stego Industries 15 mil Stego Wrap Vapor Barrier membrane.
   01 Provide all materials and accessories as specified and recommended by the manufacturer for a complete under slab membrane system.

B. Provide vapor retarder membrane below all building slabs / foundations except areas described below to receive vapor barrier membrane.

C. Under Slab Vapor Retarder Membrane:
   01 Material: manufactured from a blend of the highest quality polyolefin resins.
   02 Vapor Retarder / Slab Membrane shall be a manufacturer's complete system including but not limited to membrane, joint tape, penetration boots, mastic / sealant, and other accessories as supplied by the manufacturer.
   03 High strength, flexible, polyolefin resin based, low-permeance, geo-membrane vapor retarder system.
   04 Meeting or exceeding all requirements of ASTM E1745, Class A.
   05 Thickness: 15 mils minimum; no exceptions.
   06 Water Vapor Permeance rating of less than 0.01 perms as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1.2 – 7.1.5.
   07 Puncture Resistance: Exceeds 2,300 grams per ASTM D1709 Method B.
   08 Tensile Strength: Exceeds 55 PSI per ASTM D882.

2.4 VAPOR BARRIER BELOW-SLAB MEMBRANES

A. Design of Vapor Barrier Membrane is based on Stego Industries 20 mil Stego Wrap Vapor Barrier membrane.
   01 Provide all materials and accessories as specified and recommended by the manufacturer for a complete under slab membrane system.

B. Provide vapor barrier membrane below all building slabs / foundations scheduled or shown to receive finish wood flooring systems; to include, but not necessarily limited to:

01 Gymnasiums.
02 Dance Studios.
03 Theater Stage / Aprons.
04 Drama Rooms.

C. Under Slab Vapor Barrier Membrane:
01 Material: manufactured from a blend of the highest quality polyolefin resins.
02 Vapor Retarder / Slab Membrane shall be a manufacturer's complete system including but not limited to membrane, joint tape, penetration boots, mastic / sealant, and other accessories as supplied by the manufacturer.
03 High strength, flexible, polyolefin resin based, low-permeance, geo-membrane vapor retarder system.
04 Meeting or exceeding all requirements of ASTM E1745, Class A.
05 Thickness: 20 mils minimum; no exceptions.
06 Water Vapor Permeance rating of less than 0.01 perms as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1.2 – 7.1.5.
07 Puncture Resistance: Exceeds 3,500 grams per ASTM D1709 Method B.
08 Tensile Strength: Exceeds 97 PSI minimum per ASTM D882.

2.5 OTHER VAPOR MEMBRANES MATERIALS AND ACCESSORIES

A. Vapor Retarder Membrane Seam Tape and Perimeter Seal:
01 Design is based on Stego Industries "Crete Claw" seam tape with a heavily textured top that forms a mechanical bond to the wet concrete.
02 Width: minimum 6".
03 High density polyethylene tape with pressure sensitive adhesive specifically formulated for use with the polyolefin membrane.
04 Permeance: 0.03 maximum.
05 Thickness: shall be same as membrane or thicker.
06 In addition to application at membrane seams, apply tape on a maximum 10' x 10' grid throughout the membrane surface to assure consistent and complete attachment to the structural concrete foundation.

B. Membrane Penetrations:
01 All penetrations through the vapor barrier membrane shall be completely sealed.
02 Methodology shall be as recommended by the manufacturer.
03 Design is based on Stego Tape and Stego Mastic in accordance with manufacturer's standards and recommendations for the specific application.
04 Other methods (i.e. preformed boots) will be consider based on manufacturer's recommendations, subject to approval by the Architect.

C. System Requirements:
01 The vapor retarder membrane shall be a system specifically designed or suited to be applied to a structural concrete foundation where the slab is elevated above grade.
02 The vapor retarder system must adhere to the underside of the foundation and remain in place after deterioration of the cardboard carton forms used to form the structural slab.
03 Attachment to the structural foundation by any means that penetrate the vapor barrier membrane shall not be accepted.
04 The perimeter grade beams of the structural foundation shall bear on subgrade. The system shall extend to the outside face of the grade beams and be similarly permanently attached.

D. Accepted methods of membrane attachment to underside of structural foundation:
   01 Use of a seam tape and / or seam tape grid that is capable of permanently bonding with the concrete at the time it is poured (basis of design).
   02 Use of a membrane that has an integral fleece back designed to permanently bond with the concrete at the time it is poured.

PART 3 - EXECUTION

3.1 PREPARATION

A. Foundation Preparation: Verify the following is complete and acceptable prior to installation of under slab membranes:
   01 Foundation formwork.
   02 Underground work of other trades.
   03 All work that will penetrate the vapor membrane.

B. Verify the area to receive under slab membranes is free from other trade work, obstructions and / or foreign objects that may puncture the membrane after installation.
   01 Notify Contractor of any issues and / or concerns and do not proceed until satisfactorily resolved.

C. Drilled Piers / Plinths: Thoroughly clean concrete plinths and prepare for sealing under slab membrane to pier tops / plinths in accordance with membrane manufacturer's installation instructions.

D. Provide a means of sealing form stakes and other temporary penetrations through the under slab membrane.

E. VaporStakes® or other approved permanent stakes, sealed with mastic or seam tape at membrane penetration as recommended by the membrane manufacturer, and approved by the Architect.

F. Temporary form block-out that will allow patching membrane after the stake is removed; leaving room for patching and sealing membrane.

3.2 UNDER SLAB MEMBRANE INSTALLATION

A. Install membrane systems in strict accordance with manufacturer's recommendations and requirements, and in accordance with ASTM E1643.
   01 Installation shall provide a continuous, sealed membrane barrier beneath all building foundation area and below all grade beams through to the top of the exterior face.
   02 If / where membrane is interrupted (i.e. drilled footings, plinths, and similar), membrane shall be sealed to concrete surface per manufacturer's recommendations.
   03 Membrane shall extend through and up outside face of perimeter grade beams to finish grade line.
   04 Membrane shall be integrally and continuously attached to grade beam outside face per manufacturer's recommendations.

B. Install Vapor Retarder membrane system below all building foundations on properly compacted structural fill pad.

C. Lay out membrane in as full sheets as possible, minimizing the amount of joints / seams.

D. Lap joints / seams 6” minimum and seal continuously with membrane manufacturer’s system joint tape covering full laps in accordance with manufacturer’s instructions.
   01 Clean all debris, dirt and other contaminants from membrane surfaces to receive joint tape.

E. Penetrations by Other Trades:
   01 Work by other trades that penetrate membrane from subgrade to above slab shall be sealed 100% to ensure and maintain under slab barrier effectiveness.
   02 Provide manufacturer’s tape, mastic, preformed boots or accurately cut, site fabricated membrane boots per manufacturer’s instructions and recommendations.
   03 All penetration sealing assemblies shall above finish slab elevation a minimum of 6” and be sealed with seam tape and / or mastic to penetrating object.
   04 Where multiple penetrations occur in close proximity, use mastic to completely fill all voids and potential areas where water vapor could penetrate the assembly in strict accordance with manufacturer’s standards recommendations.

F. Temporary Form Penetrations:
   01 Where temporary forms are used to separate slab pours create slab recesses and other types of offsets, supporting stakes penetrations through the slab membrane shall be sealed 100%.
   02 Acceptable permanent stakes to remain in the slab are acceptable, provided they are sealed with mastic in accordance with manufacturer’s installation instructions. Wood stakes are not acceptable permanent stakes.
   03 Where temporary stakes are removed from the finished slab, provide an acceptable means by which the hole through the membrane can be patched and sealed with membrane, seam tape and / or mastic.
   04 Completely fill stake voids with concrete as soon as practical while slab concrete is still plastic.

G. Take all necessary precautions during concrete placement as required to prevent puncture of the under slab membrane.
   01 During concrete placement, continuously monitor / inspect the under slab membrane.
   02 Seal any / all membrane punctures before placement of concrete.

3.3 INSTALLATION CERTIFICATION

A. The vapor barrier membrane manufacturer shall provide the services of a qualified representative to provide the following services:
   01 Inspect the building foundation / slab prep to determine it is suitable for the membrane installation to commence.
   02 Inspect the membrane installation during installation to confirm all requirements, standards and recommendation are being strictly adhered to.
   03 Inspect the final foundation prep 24 hours prior to placement of concrete to verify that the vapor membrane system is correct.
   04 Be present during concrete placement to observe that all requirements regarding the vapor membrane system are being adhered to.

B. Correct all deficiencies noted by the inspector as required for his approval.

C. Provide a letter from the manufacturer certifying the installation is complete and acceptable to proceed with placement of concrete.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide all concrete and concrete accessories required for a complete installation.
   02 Building Foundation: Including drilled piers, grade beams, spread footings foundation walls, and / or slab on grade.
   03 Steel structure supported slabs.
   04 Site paving, curbs flatwork and sidewalks.
   05 Foundations for site lights.
   06 HVAC equipment support structures and housekeeping pads.
   07 Athletic fields and events.
   08 Coordinate with all other trades to confirm requirements and scope required for all associated work.

C. Related Work:
   01 Section 01 22 00 – Unit Prices.
   02 Section 01 45 29 – Inspection Testing Lab
   03 Section 03 15 19 – Below Slab Vapor Membrane.
   04 Section 03 52 16 – Lightweight Insulating Concrete.
   05 Section 03 54 16 – Hydraulic Cement Underlayment
   06 Section 03 54 17 – Self-leveling Floor Underlayment
   07 Section 31 15 00 – Site Clearing and Earthwork.
   08 Section 31 32 13.19 – Lime Soil Stabilization.

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements. This shall include data for reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems and curing compounds.

C. Mix Designs:
   01 Submit proposed mix designs for each different concrete mix proposed to be furnished, including adequate historical documentation of previous use to substantiate performance and strengths.
   02 Submit concrete mix design and aggregate analysis for each concrete strength.

03 Designs shall be submitted a minimum of 14 days prior to placing concrete.

04 Submit separate mix designs when admixtures are required for the following:

a. Hot and cold weather concrete work

b. Air entrained concrete work

c. Pump mix design (if allowed).

D. Tests and Certifications:

01 Before starting any work under this section, make all required arrangements with the testing agency. The testing laboratory shall test and furnish certified reports on proposed cements, aggregates, mixing water and admixtures.

02 Submit proposed design mixes for each type of concrete using previously tested and approved materials.

03 Furnish certified reports of each proposed mix for each type of concrete.

04 Proportion mixes by laboratory trial batch or field experience methods, using materials to be employed in the work for each class of concrete required, and report to the Architect.

05 Refer to section 01 45 29 – Testing and Inspection Services for on-site procedures and testing requirements.

06 Furnish ready mix delivery tickets.

07 Notify Architect/Engineer and Testing Lab a minimum of 24 hours prior to commencement of operations. Contractor shall maintain a sign-in sheet for third party inspections (testing labs).

08 Architect/Engineer and Geotechnical Consultant to inspect steel reinforcement for compliance prior to the concrete pour and monitor all concrete placement.

E. Shop Drawings:

01 Shop drawings for all reinforcing steel. Show bending diagrams, splicing and laps of rods, shapes, dimension and details of bar reinforcement and accessories.

02 Shop drawings showing location of all proposed construction and control joints, keying / keyways, water stops, openings, depressions, trenches, sleeves, inserts, and other items affecting reinforcement and placement of concrete.

03 Placement sequence schedule may be combined with Item 02.

04 Unless shown on the Site Plan, submit proposed layout for all expansion joints in paving, flatwork and sidewalks.

F. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.

01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.

02 Generic details that do not depict actual conditions shall not be acceptable.

G. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.

01 Include recommended cleaning products and instructions for use.

02 Where applicable, provide recommended maintenance schedules and procedures.

H. Color / Finish Samples for Colored Concrete
   01 Provide two (2) samples of each finish for selection by the Architect.
   02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
   03 Minimum size shall be 3" x 3", but must be large enough to convey attributes of the proposed product.

I. Actual Samples of Proposed Materials: Provide two (2) actual samples of the following products proposed to be furnished.
   01 Plastic rebar chair supports.
   02 Water stops.
   03 Stains: full range of manufacturer's available color selections.

1.3 REFERENCES

A. American Concrete Institute:
   01 Detailing Manual.
   02 ACI 301 – Specifications for Structural Concrete.

B. U.S. Federal Specifications:
   01 Fed. Spec. SS-S-158.
   02 Fed. Spec. SS-S-164.

C. American Society for Testing and Materials:
   01 ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.
   02 ASTM A615 - Steel Bars for Concrete Reinforcement.
   03 ASTM A704 - Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.
   04 ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
   05 ASTM C33-379 - Standard Specifications for Concrete Aggregates.
   06 ASTM C94 - Standard Specifications Ready Mix Concrete.
   07 ASTM C150 - Standard Specifications for Portland Cement.
   08 ASTM C260 - Specifications for Air Entraining Admixtures for Concrete.
   09 ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
   10 ASTM C494 - Standard Specifications for Chemical Admixtures for Concrete.
   11 ASTM C979 - Standard Specification for Pigments for Integrally Colored Concrete
   12 ASTM C 1315 – Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.

D. American Association of State Highway and Transportation Officials (AASHTO):
   01 AASHTO M-213-74 – Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.
   02 AASHTO M-148 – Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete.

E. Portland Cement Association: Joint Design for Concrete Highway and Street Pavement, Concrete-Typical Pavement Sections and Jointing Details.

1.4 SITE CONDITIONS

A. Environmental Conditions:
   01 Do not place concrete in contact with frozen earth.

02 Do not commence concrete placement unless temperature is at least 35°F (2°C) and rising, or slabs until the temperature rises above 40°F.
03 Discontinue concrete placement when air temperatures exceed 95°F.
04 Do not place concrete during rain unless adequate protection is provided.

B. Subgrade Conditions:
01 Inspect subgrade conditions as required to confirm adequacy for concrete work to proceed.
02 Notify Contractor of any discrepancies, deficiencies and / or issues. Do not proceed until fully resolved.

C. Equipment and Manpower:
01 Verify adequate equipment, in good working condition, is provided for all concrete pours.
02 Verify adequate manpower is provided for concrete pours.

1.5 PRE-INSTALLATION CONFERENCE

A. Refer to Section 01 31 19 – Project Meetings

B. Required attendees shall include, but is not limited to:
01 Contractor's Superintendent(s)
02 Contractor's Project Manager(s)
03 Subcontractor's Foreman
04 Architect's Representative
05 Civil Engineer's Representative
06 Owner or Owner's Representative
07 Material Testing Lab's Representative

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Joint Sealant:
01 Sonneborn.
02 Pecora.
03 Tremco.
04 W.R. Meadows.

B. Acceptable Manufacturers: Reinforcing Chairs:
01 OCM, Inc.
02 Dayton Aztec Castle Chairs.
03 No other substitutions.

C. Acceptable Manufacturers: Water-stops (also refer to structural drawings):
01 Henry Company – Synko-Flex.
02 Durajoint – Seal-Tite.
03 Vinylex Corporation – Blue Stop.

D. Acceptable Manufacturers: Curing Compound:
01 Nox-Crete- Cure & Seal 100-300 E.
02 Sonneborn – Kure-N-Seal.
03 Shepler's – Shep-Cure 309 Rez All.
04 W.R. Meadows – Vocomp-20.

E. Acceptable Manufacturers: Concrete Color Pigment (Stain):
   01 Bomanite
   02 L.M. Scofield.
   03 Davis Colors.
   04 New Riverside Ochre Co., Inc.

2.2 CONCRETE MATERIALS

A. Concrete:
   01 General:
      a. Ready-mixed concrete, ASTM C94.
      b. Comply with ACI 318.
      c. Concrete must be approved by Architect through design mix and cylinder test of testing laboratory.
   02 Cement: Type 1, ASTM C150, unless approved otherwise by the Architect. Use one brand of cement for entire project.
   03 Aggregates:
      a. Comply with ASTM C33. Aggregate shall be limestone at paving.
      b. Maximum size not larger than one-fifth of the narrowest dimension between forms of the member for which concrete is to be used. Not larger than three-fourths of minimum clear spacing between reinforcing bars.
      c. Maximum 1 ½ inches in building slabs.
   04 Admixtures:
      a. Approval necessary from Architect and testing laboratory.
      b. Calcium Chloride: Not permitted.
      c. Color Pigment: At areas indicated on drawings provide pigment at 5 pounds per 94 pound sack of cement. Follow manufacturers' recommendations.
   05 Strengths:
      a. 5 sack/3000 psi/28 days: all concrete including grade beams, footings, slabs, pavements, walks.
      b. Strength recommendations on structural drawings supersede when they are greater than specified here.
   06 Water: Drinking quality.
   07 Slump:
      a. Footings – 5 inches to 8 inches.
      b. Slabs on grade – 4 inches to 6 inches
      c. Elevated slabs on metal deck (3/4" max. aggregate) – 3 inches to 5 inches.
      d. Pavement – 5-1/2 inch max.
      e. All other concrete – 4 inches to 6 inches
      f. Slump shall be measured from samples taken at the point of discharge unless agreed upon in writing by Architect/Engineer prior to concrete placement.

B. Metal Reinforcing Bars:
   01 General: Conform to ACI Publication 315, latest edition.
   02 Comply with ASTM A615, Grade 60.
   03 #3 bars comply with ASTM A615, Grade 40.

C. Welded Wire Mesh:
   01 Conform to ASTM A185.
   02 Wire Mesh Gauge: 9 gauge.
   03 Shall be type which is fabricated and delivered to job site in flat sheets. Rolls of mesh shall not be acceptable.

D. Joints:
   01 Construction Joint (Building Slab):
   02 Standard type permanent galvanized keyed contraction expansion joints, with 5 stakes per 10 feet of joint length.
   03 Joint may be left in place when concrete is placed on each side simultaneously. Remove when mold as edge form prior to subsequent concrete placement.
   04 Expansion Joint:
      a. Fiber Joint Filler: ¾ inch thick, pre-molded asphalt impregnated rigid fiber board. Comply with AASHTO M-213-74 or redwood.
      b. Cap sealant:
         i. Refer to Section 07 92 00 – Joint Sealants
         ii. If not specified in section 07 92 00, provide sealant to comply with Fed. Spec. TT-S- 00227E “Two Component”, 100% Urethane.
         iii. Color to be light grey.
   05 Tooled Joint: Scored ¼” wide x ¼” the thickness of the concrete in depth.
   06 Saw-Cut Joint: 1/8” wide x ¾” to 1” deep.

E. Waterstops – Flexible:
   01 Design based on Henry Company SF302 Synko-Flex Waterstop; or accepted equal.
   02 Asphalt based, non-hydrophilic / non-expanding waterstop.
   03 Continuous, flexible, moldable strip with protective wrapping.
   04 Size: 1” wide x ¾” deep.

F. Rebar Chairs and Spacers:
   01 OCM, Inc. – “Plastic Cradle Chair”.
   02 Aztec “Castle Chair”.
   03 Heavy-duty plastic-type sized to support all slab steel at proper height.
   04 Use type with sand cushion pads where concrete is on grade.

G. Form Ties:
   01 Form Ties: Adjustable length and type which will not leave holes larger than 1 inch in diameter in the face of the concrete.
   02 Ties shall be such that when forms are removed, no metal will be within 1 inch of the finished concrete surface.
   03 The holes must be patched.

H. Curing Compound: Design is based on WR Meadows VOCOMP-20; or equal by an acceptable manufacturer.
   01 Water based, dissipating curing compound for freshly placed concrete.
   02 Comply with ASTM C309 Type 1.
   03 Minimum 18% solids.
   04 Meets all VOC emission requirements.
   05 Initially non-clear for visual verification of adequate coverage.
   06 Coordinate curing material with flooring manufacturer.

I. Cardboard Carton Void Forms: Permitted only if specifically indicated on the Drawings.
   01 Wax impregnated, trapezoidal shape.
   02 Use only if / where indicated on the structural drawings.

2.3 COLORED CONCRETE

A. Design of colored concrete is based on products / systems manufactured by Bomanite.

B. Field Colored Concrete: Equal to Bomanite “Color Hardener” system – Heavy Duty Grade for high wear resistance.
   01 A blend of mineral oxide pigments, cement and graded silica aggregates applied to freshly placed concrete as recommended by the manufacturer.
   02 Color as selected by Architect from full range of manufacturer’s colors.
   03 Provide at all ramps as required by Americans with Disabilities Act and Texas Department of Licensing and Registration “Texas Accessibility Standards”.
   04 Provide at all areas designated “Colored Concrete”.

C. Batch Plant Colored Concrete: Equal to Bomanite “Integral Color” color admixture system.
   01 Comprised of high quality pigments and other ingredient designed to enhance the color and pigment dispersion, workability and finishing performance of the concrete.
   02 Integral Coloring Admixture: Bomanite Integral Color synthetic oxide pigment meeting requirements of ASTM C979 and C494; in type as recommended by the manufacturer for the specific application.
   03 Integral color shall be added to concrete at the batch plant as recommended by the manufacturer.
   04 Once mixed, no water shall be added to the design mix to maintain quality and consistency of the color.
   05 Color as selected by Architect from full range of manufacturer’s colors.
   06 Provide at all areas designated “Colored Concrete”.

D. Imprint System: Equal to Bomanite “Bomacron” textured imprint templates as selected by the Architect.
   01 Pattern shall be light to medium texture “slate”.

E. Release Agent: As recommended by the manufacturer for the specific installation.

F. Curing Agent: Equal to Bomanite “Clear Cure”.

G. Sealing and Finishing Coat: Equal to Bomanite “Hydroblock”.

2.4 SLAB MEMBRANES

A. Refer to section 03 15 19 – Below Slab Vapor Membranes.

PART 3 - EXECUTION

3.1 PREPARATION

A. General:
   01 Clean all mixing and transportation equipment; remove debris from forms; wet forms thoroughly; remove ice or other coatings from reinforcement which might hinder good bond; remove water from place of deposit; and check reinforcement.

B. Accessories: Install anchor bolts, slots, dove-tail anchor slots, boxes, sleeves and other required devices. Provide all such items not specified to be provided by other trades.

01 Provide temporary supports to maintain accessory location / position during concrete placement and initial finishing. Remove temporary supports as required.

C. Coordination:
01 Unless specifically shown or allowed in other specification sections and / or drawings, no horizontal runs of conduit, piping or other work shall be allowed within the slab.
02 All underground conduit runs (if allowed) shall be trenched / installed within the building pad, a minimum 6” below the slab. Refer to electrical drawings and specifications.
03 Exception to 02: Only conduit runs to floor mounted or recessed receptacles at finish floor may be installed above the slab membrane provided all following conditions are met:
a. 3/4" maximum conduit size allowed provided the conduit is recessed below the slab thickness indicated.
b. Length of conduit run is minimized to turn up at the nearest available building component (partition, furring, etc.) to allow conduit to be concealed above the slab.
c. Such installations are not specifically excluded in other sections or the Drawings.
04 All penetrations through concrete grade beams and elevated beams shall be sleeved.
05 Coordinate with other contractors / trades as required for proper installation of interfacing work; and monitoring of such work during placement and finishing of concrete. All interfacing work displaced during concrete placement will be required to be moved to proper location.
06 Coordinate concrete pours to eliminate or minimize cold joints or expansion joints in building slabs, particularly in main corridors and dining/commons areas. Joint quantities and locations to be coordinated with Architect and Structural Engineer prior to concrete placement.
07 Install brass survey pins in concrete curbs at locations of all irrigation sleeves.
08 For all exterior concrete penetrations where steel is in contact with the concrete, ensure fill is crowned so water does not stand, causing rust to form of metal object.

D. Subgrade:
01 Prior to placement of slab membrane, inspect the building pad / subgrade and verify that all foreign objects have been removed.
02 Verify that the subgrade is level, compacted and evenly graded. Hand rake where required.
03 Remove all material that could potentially puncture or stress the slab membrane.

E. Drilled Piers:
01 Do not begin drilled pier operations until provisions are in place to assure that placement of reinforcing and concrete shall occur as soon as possible after finishing drilling the pier.
02 In no case shall drilled piers be left open / unfinished overnight.

3.2 INSTALLATION

A. Drilled Piers:
01 When drilled piers are shown to be vertical, bore shafts plumb within tolerance of up to 2” over the length of the shaft.

02 To ensure proper bell / under ream size, use chains as required on the bell auger; or alternatively, use appropriate size bell auger.
03 Install closely spaced piers in alternating sequence as required to prevent caving and / or leakage of concrete.
04 Fill each pier with concrete as soon as practical. Under no circumstances shall drilled piers be left unfilled overnight.
05 Keep bell / under ream base thoroughly clean and free of water before concrete is placed.
06 Fill bell / under ream with concrete and vibrate with a pencil vibrator. Do not over vibrate.
07 After bell / under ream is poured, set reinforcing cage as required to allow for minimum 3" coverage of concrete at base. Dropping reinforcing cages into pier shall not be allowed.
08 Fill pier shaft with concrete up to required elevation. Once placed, consolidate concrete with a pencil vibrator. Do not over vibrate.

B. Forms:
01 Conform to the shapes, lines and dimensions of the members as shown on the drawings, except as modified under Section 31 20 00 – Earth Moving of these specifications.
02 Care shall be taken to assure that formwork does not stain concrete surfaces.
03 Slab Block-Outs:
a. Diamond configuration at paving drains and building slabs.
b. Coordinate with concrete joints, verify with Architect.
04 Slope exterior concrete slabs away from building and slope interior slabs to floor drains. Verify all slopes with Architect prior to start of concreting.
05 Forms:
a. Grade beams shall be formed to the sizes indicated on the drawings.
b. Where carton forms are not required, the contractor may omit forms of grade beams provided the grade beam is widened 1 1/2 inches on each side in contact with the earth.
c. The top 12 inches (minimum) of the outside faces of exposed perimeter grade beams must be formed. Unformed perimeter grade beams shall not be allowed above the surface of finish grading.
d. If forms are used, then the widening of the grade beams are not required.
06 Carton Forms: Permitted only if specifically indicated on the Drawings.
a. Where carton forms are required, both sides of the grade beam shall be formed.
b. Fasten carton form in place to eliminate movement / shifting during concrete placement.
c. Take all necessary precautions to keep carton forms dry prior to concrete placement. In the event they become wet, remove and replace with dry, rigid forms.
07 Slab Recesses and Sloped Surfaces:
a. Accurately form all slab recesses to depths indicated on the Drawings.
b. Where Drawings indicate slab(s) to slope, accurately form sloped areas and screed to provide a uniform slope.
c. Contractor shall have the option to form recessed and sloped areas a minimum of 2 inches deeper than indicated and top-out recess at a later date to finished elevations.
08 Form Removal:

a. Ensure safety of the structure.
b. In no case shall the supporting forms or shoring be removed until the members have acquired sufficient strength to support their weight and the load thereon.
c. Form lumber shall be discarded. It shall not be used for other construction materials.

C. Vapor Membrane:
01 Refer to section 03 15 19 – Below Slab Vapor Membrane.
02 Verify that vapor membrane installation is 100% complete and approved prior to start of reinforcement installation and / or slab prep work.
03 Immediately repair and / or replace vapor membrane if damaged during concrete work preparation or placement.

D. Reinforcing:
01 Cleaning Reinforcement: Free from rust, scale or other coatings which will destroy or reduce the bond.
02 Placing Reinforcement:
a. Place accurately and adequately secure in position.
b. Reinforcement in all concrete slabs shall be held in proper locations by use of plastic chairs spaced a maximum distance of 48 inches o.c., unless noted otherwise.
03 Coverage of Reinforcement: The metal reinforcement shall be protected by the thickness of concrete indicated on the plans.
a. 3 inch: Concrete deposited against ground without use of forms.
b. 2 inch: Bars more than 5/8 inch diameter where concrete is exposed to the weather, or exposed to the ground but placed in forms.
c. 1-1/2 inch: Bars 5/8 inch diameter where concrete is exposed to the weather, or exposed to the ground but placed in forms.
d. 3/4 to 1 inch: In slabs and walks not exposed to the ground nor to the weather, not less than 3/4 inch. Increase coverage and slab thickness at auditorium seating to miss seat anchors. Refer to Structural Drawings.
e. Not less than 1 1/2 inches in beams, girders and columns not exposed to the ground nor to the weather.
f. 1-1/2 to 1-3/4 inches from top: Paving.
04 Mesh: Locate as shown on the drawings. Place on chairs. During concrete placement, verify that mesh is pulled up into concrete pour.

E. Waterstops:
01 All non-rigid waterstops shall be installed in a continuous keyway cast into the (receiving) concrete. Keyways shall be formed with 2x4's with canted sides to form a trapezoid shape.
02 Concrete to receive waterstops shall be dry and free of contaminates.
03 Where required, prime concrete in accordance with manufacturer's standards and recommendations.
04 Install waterstops in continuous lengths, firmly adhered to receiving concrete surface.
05 Overlap at splice joints in accordance with manufacturer's standards and recommendations.
06 Leave protective wrapping in place until ready to cover with fresh concrete.

F. Joints:
01 Construction Joints:

a. Floor slabs shall be formed using metal screed joints. Verify locations of all control joints not indicated on the drawings with the Architect, in ample time to avoid construction delay.
b. Use at cold joints in building.

02 Contraction Joints: Refer to Structural drawings.

03 Expansion Joints:
a. Where walks and paving terminates against curbs or buildings, and at sides adjacent to curbs building or walls, whether detailed or not. Verify locations with the Architect if either redwood or asphalt impregnated fiber with sealant cap.

04 Tooled Joints: Provide scored lines on exterior concrete slabs and walks.

G. Concrete:

01 Batching, Mixing and Delivery Equipment: Use transit mixed concrete from approved batching and mixing plant. Batch, mix and transport concrete to the site in accordance with provisions of ASTM C94.

02 Inspection: Examine all areas and conditions under which the work of this section will be performed. Correct any conditions detrimental to the approved completion of the work. Do not proceed until all such conditions are corrected.

03 Concrete Placement (general):
a. Place concrete in compliance with practices and recommendations of ACI-304, and as specified herein.
b. Do not deposit concrete on concrete which has hardened sufficiently to form seams or planes of weakness within the section.
c. Where a section cannot be placed continuously, provide construction joints.
d. Place concrete at such a rate that concrete which is being integrated with fresh concrete is still plastic.
e. Deposit concrete as nearly as practicable in its final location to avoid segregation due to re-handling and flowing. Do not subject concrete to any procedure which might cause segregation.
f. Screed concrete which is to receive other construction to the proper level, to avoid excessive skimming and grouting.
g. Do not use concrete which becomes non-plastic and unworkable, or does not meet the required quality control limits, or which has been contaminated by foreign materials.

04 Placement Schedule: Place concrete in conformance with a placement schedule to ensure even distribution of loads.
a. Alternate placement to allow for shrinkage.
b. Where construction joints are shown or required, alternate panels, allowing a minimum of 7 days curing time prior to placing adjacent panels.

05 Conveying:
a. Handle concrete from point of delivery and transfer to conveying equipment to the location of final deposit as rapidly as practicable, and by methods which prevent segregation and loss of mix materials.
b. Provide runways for wheeled conveying equipment from delivery point to location of final deposit.
c. Keep interior surfaces of conveying equipment, including chutes and tremies, free from hardened concrete, debris, water and other deleterious materials.

d. Pumps may be used only if they can pump the designed mix. Do not add fine aggregate or water to the mix to satisfy needs of a pumping device.
e. Use chutes or tremies for placing concrete where a drop of 10'-0" or more is required.

06 Slab Placement:
a. Moisten subgrade the evening before and immediately prior to placement of all paving slabs.
b. Deposit and consolidate concrete slabs in a continuous operation, within the limits of any construction joints, until the placing of a panel or section is completed.
c. Consolidate concrete during placement by use of the specified equipment, thoroughly working concrete around reinforcement and into corners.
d. Consolidate concrete placed in beams and girders of supported slabs and against bulkhead of slabs on grade, as specified for formed concrete structures.
e. Consolidate concrete in remainder of slabs by vibrating bridge screeds, roller pipe screeds or other methods acceptable to the Architect.
f. Limit time of vibrating consolidation to prevent bringing an excess of fine aggregate to the surface.
g. Bring slab surfaces to correct level with a straight edge, and then strike off.
h. Use bull-floats or darbies to smooth the surface, leaving it free from bumps and hollows.
i. Do not sprinkle water on the plastic surface; do not disturb the slab surfaces prior to start of finishing operations.

07 Cold Weather Placing: Comply with ACI-306 to protect all concrete work from physical damage and reduce strength caused by frost, freezing actions, or low temperatures. Place no concrete against frozen earth.
a. Use of Calcium Chloride accelerators.

08 Hot Weather Placing: Prepare aggregates, mix water and other ingredients, and place, cure, and protect concrete in accordance with the requirements of ACI-305.

09 Consolidation:
a. Consolidate all concrete footings, piers, grade beams, slabs, paving, etc. in accordance with provisions of ACI-309.
b. Consolidate each layer of concrete immediately after placing, using internal concrete vibrators supplemented by hand-spading, rodding or tamping.
c. During all phases of operation, maintain a frequency of not less than 10,000 vibrations per minute per internal vibrator.
d. Provide adequate number of units and power source at all times. Maintain spare units on hand to ensure adequacy.
e. If, in the opinion of the Architect, the equipment is not adequate to accomplish proper consolidation, he may order delay in further placement until adequate equipment is made available.
f. Maintain vibrators to assure peak efficiency at all times during placement.

H. Colored Concrete – Color Hardener:
01 While concrete is still in the plastic stage of set, apply Bomanite Color Hardener prior to application of pattern.

02 Apply at rate recommended by manufacturer, evenly to the surface of the fresh concrete by the dry-shake method.
03 Apply in two or more shakes, floated after each shake and troweled only after the final floating.
04 While concrete is still in its plastic state, apply the tool / texture pattern to the surface of the concrete. Properly tamp tools into the surface to achieve the required texture, with uniformity of pattern and depth of stamping. Utilize bond breaker to keep tools from sticking to fresh concrete.
05 Release material shall be applied to the troweled surface prior to imprinting.
06 Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.
07 Apply secondary stain treatment per approved mock-up or as scheduled to achieve design.
08 Apply finish sealer per approved mock-up or as specified to achieve design required.
09 Apply Bomanite recommended Colorwax in accordance with manufacturer's printed instructions in colors to match the colored concrete selected.

I. Wet Curing:
01 All interior slab areas shall be water cured for a minimum of five (5) days.
02 Maintain wetness of slab areas by suitable means (sprinklers, drip hoses, water blankets, etc.) for a minimum of five (5) days.

3.3 FINISHES AND TOLERANCES

A. Finishes – Grade Beams and Vertical Surfaces:
01 Exposed surfaces of all concrete walls and grade beams shall receive a rubbed finish, unless otherwise noted. Immediately after forms are removed, grout pits and recesses and rub with carborundum stone to a smooth finish, free from marks or honeycomb to the Architect's satisfaction. Finish exterior surface 2 inches below finish grade.
02 Rubbed finish shall be of the finest workmanship, with uniform texture and color.
03 Prepare samples for approval of Architect.
04 Protect all rubbed finish against damage during construction period. Immediately before requesting final acceptance of work, the Contractor shall remove protection and do such touch up and rubbing as necessary to leave rubbed surfaces in perfect condition.
05 Miscellaneous Vertical Surfaces: Finish all vertical surfaces, including but not limited to curbs, risers, low walls and stringer, while concrete is strong enough to stay in place without forms yet green and able to be finished to a homogeneous appearance.

B. Finishes – Interior Slabs:
01 Spreading of dry cement for finishing is not permitted.
02 Flooding floor is not permitted during finishing. A limited, light / sprinkled application of water shall be permitted.
03 Interior slabs to receive direct applied finish flooring: provide a troweled smooth flat matte finish.
04 Interior slabs to remain concrete or receive an epoxy-type finish: Provide a smooth, hard-troweled finish. Provide and maintain protection from construction stains and finish damage for all exposed concrete.

05 Moisture mitigation required due to over troweling concrete slabs to the point that moisture is trapped within the concrete slab shall be at the Contractor's sole risk and responsibility; and shall not be at any additional cost to the Owner.

06 Interior slabs to receive thickset / mud-bed finish flooring (mud-set terrazzo, thick-set quarry tile, etc.): floated, smooth finish. Coordinate exact requirements with flooring applicator.

3.4 FIELD QUALITY CONTROL

A. Testing Laboratory: Perform the appropriate tests upon notification by the Contractor. Refer to Section 01 45 23 - Testing and Inspection Services.

B. Contractor shall take necessary precautions to not over-trowel concrete slabs to the point that the finish closes pores in the concrete.

C. Tolerances – Interior Slabs at Finish Floor to Receive Adhered Flooring Materials:

01 True to plane within 3/16" over any 10 foot length, non-cumulative; ACI F-32.

02 Verify any additional requirements with the flooring installer.

D. Tolerances – Recessed Interior Slabs to Receive Composite Wood Flooring Assemblies:

01 True to plane within 1/8" over any 10 foot length, non-cumulative; ACI F-50.

02 Verify any additional requirements with the flooring installer.

E. Tolerances – Recessed Interior Slabs to Receive Built-Up or Thick-Set Flooring:

01 True to plane within 5/16" over any 10 foot length, non-cumulative; ACI F-20.

02 Verify any additional requirements with the surfacing installer.

F. Exterior Concrete Slabs: Refer to Section 32 13 13 – Concrete Paving and Flatwork.

3.5 PATCHING AND CLEANING

A. After forms are removed, remove projecting fins, bolts, form ties, nails, etc., not necessary for the work, or cut back 1 inch from the surface. Where, in the Architect's opinion, surface defects occur, such as honeycombing, repair the defective areas as directed by the Architect. Joint marks and fins in exposed work shall be smoothed off and cleaned as directed by the Architect.

B. Repair defects in concrete work per ACI-301, Chapter 9, and as directed by the Architect. Chip voids and stone pockets to a depth of 1 inch or more as required to remove all loose material. Voids, surface irregularities, chipped areas, etc., shall be filled by patching, gunite or rubbing, as directed by the Architect. Repaired surfaces shall duplicate appearance of unpatched work.

C. Clean exposed concrete surfaces and adjoining work stained by leakage of concrete to the approval of the Architect.

D. Reinforce or replace any deficient work as directed by the Architect, and at no additional cost to the Owner.

3.6 CLEAN - UP

A. In addition to the requirements of General Conditions, clean up all concrete and cement work on completion of this portion of the work, except protective coating or building papers shall remain until floors have completely cured or until interior partitions are to be installed.

END OF SECTION

SECTION 03 52 16.19

LIGHTWEIGHT INSULATING CONCRETE

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide lightweight insulating concrete deck at roof as indicated on the Drawings.
   02 Includes lightweight insulating concrete decks installed on structural steel metal deck and cementitious wood fiber decks.
   03 Provide all materials and accessories required for a complete installation.

C. Related Work:
   01 Section 05 31 00 – Steel Decking.
   02 Section 06 10 00 – Rough Carpentry.
   03 Section 07 52 00 – Modified Bituminous Membrane Roofing.
   04 Section 07 71 00 – Roof Specialties
   05 Section 07 72 00 – Roof Accessories.
   06 Section 07 22 23 – Roof Hatches and Vents.

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
   01 Mix Design: Indicate materials and proportions of proposed mix. Include thermal values, physical characteristics, product limitations and mix instructions.
   02 Manufacturer's letter of certification of the approved installer.

C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.
   04 Provide calculations demonstrating compliance with wind load and other requirements.
   05 Indicate layout of slopes, drain locations, and interruptions.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.

01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
02 Generic details that do not depict actual conditions shall not be acceptable.

E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
01 Include recommended cleaning products and instructions for use.
02 Where applicable, provide recommended maintenance schedules and procedures.

F. Manufacturer's specifications and other data for all products proposed to be furnished as needed to prove compliance with specified requirements.

G. Manufacturer's letter of certification of the approved installer.

H. Provide Certificate from installer indicating insulating concrete was prepared and applied in accordance with the manufacturer's recommendations.

1.3 REFERENCES

A. American Society for Testing and Material:
01 ASTM C150 – Standard Specifications for Portland Cement.
02 ASTM C172 – Standard Practice for Sampling Freshly Mixed Concrete.
03 ASTM C332 – Standard Specification for Lightweight Aggregates for Insulating Concrete, Group 1.
04 ASTM C495 – Standard Test Method for Compressive Strength of Lightweight Insulating Concrete.
05 ASTM C513 – Standard Test Method for obtaining Specimens of Hardened Lightweight Insulating Concrete for Compressive Strength.
06 ASTM C578 – Standard Specifications for Rigid Cellular Polystyrene Thermal Insulation.
07 ASTM C796 – Standard Test Method for Foaming Agents for Use in Producing Cellular Concrete Using Preformed Foam.
08 ASTM C869, Standard Specifications for Foaming Agents Used in Making Preformed Foam for Cellular Concrete.
09 ASTM C1077 – Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation.
10 ASTM E119 – Standard Test Method for Fire Tests of Building Construction and Materials.
11 ASTM E329 – Standard Specifications for Agencies Engaged in Construction Inspection, Testing and Special Inspection.

B. Comply with all applicable recommendations of American National Standard Institute (ANSI) A122.1, and any others referred to herein. In any conflict between referenced standards, the more stringent requirements shall govern.
01 ANSI / SPRI FX-1-2006 – Standard Field Test Procedures for Determining the Withdrawal Resistance of Roofing Fasteners.

1.4 QUALITY ASSURANCE AND TESTING PROCEDURES

A. Acceptable Applicators:

01 Applicator must be approved / licensed by the system manufacturer. Approval shall be confirmed in writing to the Architect. Written approval by the manufacturer for the applicator shall include the project by name.
02 Applicator must have at least five (5) years of satisfactory experience installing the specified system.
03 Upon request by the Architect, provide a list of at three (3) projects where the applicator has installed the specified / proposed lightweight insulating concrete deck. List shall include the name and contact information of the project architect and general contractor.

B. Testing Laboratory Services:
01 The Owner will select the Testing Laboratory and pay for the cost of tests to determine the dry density and compressive strength of the lightweight insulating concrete deck. Testing shall be determined in accordance with ASTM C495.
02 The Owner's Testing Laboratory shall perform cylinder tests and a lightweight pull test to determine the fastening pattern in the presence of the Architect and District Roof Consultant. The minimum requirement is forty pounds or more per fastener.

C. Quality Assurance:
01 The roofing assembly shall conform to the requirements of meeting the specified wind load; refer to section 01 11 23 – Code Summary or minimum wind load requirements described on the Drawings.
02 The system manufacturer's product shall be UL classified and listed in the current Underwriters Laboratories "Fire Resistance Design Directory".
03 Lightweight concrete pours to be monitored full time by the District's Roof Consultant.
04 Water tests shall be performed and witnessed by the District Roof Consultant to eliminate ponding of water. Anything that covers a nickel after 24 hours shall be addressed.

D. Building / Construction Components:
01 Meet or exceed established standards.

1.5 ROOF SYSTEM COORDINATION

A. Coordinate with roofing manufacturer / contractor as required to assure compatibility of the lightweight insulating roof deck with the performance and installation criteria of the specified basis of design roofing system.

B. If a roofing system other than the basis of design system is used on the project, coordinate as required to assure compatibility of the light-weight insulating roof deck with the performance and installation criteria of the roofing system.

C. Modify the design performance of the lightweight insulating roof deck as required to meet requirements of the roofing system to be installed.

1.6 PRE-INSTALLATION CONFERENCE

A. Refer to section 01 31 19 – Project Meetings

B. Required attendees shall include, but is not limited to:
01 Contractor's Superintendent(s)

02 Contractor's Project Manager(s)
03 Subcontractor's Foreman
04 Architect's Representative
05 Owner or Owner's Representative
06 Owner's Roofing Consultant
07 Material Testing Lab's Representative

1.7 WARRANTY

A. Shall be covered under the Roofing Manufacturer's 20-years warranty. Refer to section 07 52 00. Warranty shall be all inclusive for full roof system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The design of Lightweight Insulating Concrete is based on systems / products manufactured and supplied by Siplast

B. The following additional manufacturers are acceptable to provide the work of this section, provided their proposed systems / products meet or exceed all specified requirements:
01 Vermiculite Products Inc.

2.2 LIGHTWEIGHT CONCRETE - OPTION A ("ZONOLITE" BY SIPLAST)

A. Aggregate:
01 Vermiculite: Comply with ASTM C332, Group 1.
02 Mix shall be 1:5 with minimum 200 psi at 28 days compressive strength; 50 to 60 PCF cast density, and 25 to 30 PCF dry density.
03 Vermiculite aggregate proposed for use shall be certified as being asbestos free.
04 Approved Product: Zonolite Concrete Aggregate

05 Cellular: Foaming agent shall comply with ASTM C869 when tested in accordance with ASTM C796.
06 Cast density of 36 to 44 PCF.
07 Minimum dry density of 26 PCF.
08 Minimum 28-day compressive strength of 250 PSI.

B. Cement: Portland, conforming to ASTM C150, Type I, I/II or III.

C. Admixture: As recommended and approved by system manufacturer.

D. Reinforcing Fibers: 3/4 inch long, polypropylene fiber, "Fibermix" as manufactured by Fibermesh Co.

E. Water: Free from any materials harmful to concrete or structural steel deck.

F. Expansion Joint Material: 1" thick asphalt-impregnated board approved by the manufacturer for use in conjunction with and insulating concrete deck.

G. Metal Deck: Refer to structural drawings and specifications for size, type and section modulus of metal deck.

01 Steel deck perforations for aggregate insulating concrete shall not exceed 1.5% open area.

H. Curing Compound: As required by the insulating concrete manufacturer and applied in accordance with the manufacturer's instructions.

2.3 LIGHTWEIGHT CONCRETE - OPTION B ("VERMICULITE" BY VPI)

A. Design Mix:
   01 Prepare design mixes for each type and strength of lightweight insulating concrete by either laboratory trial batch or field test date methods. For the trial batch method, use a qualified independent testing agency for preparing and reporting proposed mix designs.
   02 Do not use the same testing agency for field quality control testing.
   03 Do not use calcium dioxide in lightweight concrete.

B. Aggregate light weight concrete
   01 Design mix to produce lightweight insulating concrete with the following minimum physical properties using the minimum amount of water necessary to produce a workable mix.
   02 Do not exceed maximum air content recommended by aggregate manufacturer.

C. Aggregate:
   01 Vermiculite: Comply with ASTM C332, Group 1.
   02 Mix shall be 1:5 with minimum 200 psi at 28 days compressive strength; 50 to 60 PCF cast density, and 25 to 34 PCF dry density.
   03 Vermiculite aggregate proposed for use shall be certified as being asbestos free.
   04 Approved Product: Vermiculite by VPI

D. Cement: Portland, conforming to ASTM C150, Type I, I/II or III.

E. Admixture: As recommended and approved by system manufacturer.

F. Reinforcing Fibers: 3/4 inch long, polypropylene fiber, "Fibermix" as manufactured by Fibermesh Co.

G. Water: Free from any materials harmful to concrete or structural steel deck.

H. Expansion Joint Material: 1" thick asphalt-impregnated board approved by the manufacturer for use in conjunction with and insulating concrete deck.

I. Metal Deck: Refer to structural drawings and specifications for size, type and section modulus of metal deck.
   01 Steel deck perforations for aggregate insulating concrete shall not exceed 1.5% open area.

J. Curing Compound: As required by the insulating concrete manufacturer and applied in accordance with the manufacturer's instructions.

2.4 INSULATION BOARD – OPTION A ("INSULPERM" BY SIPLAST)

A. To be used with Option A lightweight insulting concrete mix.

B. Rigid, closed cell, un-faced Expanded Polystyrene (EPS) board stock complying with ASTM C578.

C. Thickness: six (6) inches minimum to achieve an R-value of R-25 minimum.

D. Nominal Density: 1.0 PCF, Type I

E. Fire Resistance: Flame spread – ASTM E84. Smoke Density – ASTM E84.

F. Provide a minimum of six (6) 3” diameter bond holes for each 8 SF of board.

G. Approved Product: Insulperm by Siplast

2.5 INSULATION BOARD – OPTION B (“VERMAPERM” BY VPI)

A. To be used with Option B lightweight insulting concrete mix.

B. Molded polystyrene insulation board complying with ASTM C578.

C. Thickness: six (6) inches minimum to achieve an R-value of R-25 minimum.

D. Nominal Density: 0.90 PCF, Type I

E. Fire Resistance: Flame spread – ASTM E84. Smoke Density – ASTM E84.

F. Provide approximately three percent (3%) open area

G. Approved Product: Vermaperm by VPI

2.6 ACCESSORIES

A. Roofing fasteners: “Zono-tite” by Siplast. No substitutions.

B. Vents: as required per manufacturer

2.7 DESIGN OF ROOF DRAINAGE

A. The design to drain roof areas, whether to roof drains or gutters, is generally accomplished by sloping the underlying steel structure sloping to the drainage vehicle.

B. In areas of the roof that are shown to be cricketed or similar, provide tapered rigid insulation or build up surface of lightweight concrete above the EPS insulation in the patterns shown or required to facilitate full drainage of the roof surface.
01 Area to slope at 1/4" per foot unless noted otherwise.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION

A. Prior to erection of forms, inspect structural deck to ensure all work is complete and suitable for this installation to progress.

B. Prior to placing insulating concrete, inspect corrugated metal forms to ensure that they are secured to the structure and free of debris or foreign materials. Ensure all items under slotted deck are covered and any items on the slab shall be elevated.

C. Verify that all deficiencies have been corrected prior to commencing installation.

D. Weather:
   01 Insulating concrete roof decks may be placed when temperatures are 40°F and rising.
   02 If colder temperatures are anticipated, the Applicator shall take suitable precautions for the installation of an acceptable deck.
   03 Do not place insulating concrete deck during precipitation or when there is a likely expectation that precipitation will occur during installation.
   04 Adverse weather precautions, actions and remedies shall be in strict accordance with the system manufacturer's standards and recommendations.

E. Remove water and other substances that would interfere with bonding or curing of the lightweight insulating concrete system.

F. The roofing membrane system application must be coordinated with the insulating concrete installation to avoid prolonged exposure of the roof deck.

G. Do not begin placement of the lightweight insulating concrete system until the Architect's Representative, Owner's Roofing Consultant, General Contractor and Insulation System Applicator have examined surfaces to receive the roof insulation and determine that the surface(s) are acceptable.

H. Welds on the metal deck shall be galvanized treated/painted prior to installation of light weight concrete. Welding shall be inspected by the Owner's Roof Consultant, Architect and Third Party testing lab prior to installation of light weight concrete.

3.2 INSTALLATION

A. Lightweight concrete shall be mixed in accordance with manufacturer's standards and recommendations.

B. Fill valleys / voids of structural metal deck with a leveling thickness of lightweight concrete fill.

C. Slurry coat for light weight insulating concrete fill shall be ¼" over the top of the deck.

D. Install EPS rigid insulation board in the fresh bond coat of lightweight concrete fill.
   01 Install insulation board in fresh bond coat layer in such a manner that results in the underside of insulation boards making full coverage contact with bond coat layer.
   02 EPS board shall be held back 3(+) inches from the perimeter / edges of the roof deck unless directed otherwise by manufacturer. Voids to be filled with lightweight concrete fill.

E. The EPS layer shall be placed and allowed to set overnight, undisturbed, prior to installation of the lightweight concrete roof deck topping layer.

F. Where required, place reinforcing mesh with longitudinal wires at right angles to structural supports.
   01 Lap 6 inches and tie at intersections, both sides and ends.
   02 Ensure that mesh is in approximate center of the topping fill depth.

G. Install a minimum of 2” thickness of lightweight concrete fill over EPS board, filling all bond holes, perimeter voids and other locations to produce a smooth surface suitable for the installation of the specified roofing system.
   01 The surface to receive lightweight concrete fill shall be dry, free of water, dew, frost, ice and snow at the time of placement.

H. Where indicated on the drawings increase depth of lightweight concrete fill as required to form crickets, etc. required for positive drainage.

I. Insulating concrete shall be screeded to the proper thickness and slope with a surface free of ridges and sharp projections prior to installation of the roofing membrane.

J. Cure roof deck topping in accordance with the system manufacturer’s standards and recommendations.

3.3 FIELD QUALITY CONTROL AND TESTING

A. Check the cast density at the point of placement and adjust the mix to obtain the required cast density.
   01 End of hose cast density checks shall be taken, at minimum, every thirty (30) minutes at the point of placement.
   02 Do not rod specimens.
   03 A set of test specimens shall be considered to be six (6) 3x6 cylinders made from the same sampling.
   04 Four (4) specimens from each set shall be tested for compressive strength and two (2) for dry density.

B. Protect samples from damage and temperature extremes and test accordingly at 28 days to ASTM C495.

C. Applicator shall have test equipment available on job site at all times during pouring of insulating concrete for testing slump and cast density.
   01 Slump shall not exceed 5 inches.

D. Pull Test: Conduct pull tests to document / substantiate the lightweight concrete deck meets or exceeds the minimum pull-out requirements of the specified roofing system.
   01 Testing shall be done and recorded in accordance with ANSI / SPRI FX-1-2006.

3.4 COORDINATION WITH ROOFING WORK

A. Confirm prior to placement of the lightweight concrete that the specified roof system is compatible with the type of insulating concrete to be installed.

B. Begin roofing when the insulating concrete roof deck has open air cured sufficiently to a point where subsequent work can progress without damage to the lightweight insulating concrete deck.
   01 This is usually 3 to 5 days after the deck has been placed.
   02 Confirm the Contractor has coordinated with roofing installer as required.

C. The roof deck should not be left exposed for longer than 5 to 7 days following open-air cure period.

D. Consult the roofing manufacturers for their recommended attachment of the roofing system to the insulating concrete roof deck system.

3.5 CLEANING

A. Remove visible lightweight insulating concrete from underside of metal deck where it is exposed to normal view.

B. Wash floors below the lightweight insulating concrete deck system after each day's installation or as necessary and remove wash water.

3.6 REPAIRS

A. Where required to provide surface conditions suitable to receive the specified roof system, repairs to smooth the deck surface, correct depressions or fill divots shall be performed in accordance with written guidance provided by the systems manufacturer.

B. Remove and replace any area of the roof deck that fails to comply with the requirements of the systems manufacturer, this specification or applicable product approval.

3.7 PROTECTION

A. General Contractor shall be responsible for protection of roof deck from other trades until it has been approved for traffic by installer.

B. No storage of materials shall be permitted on the new roof areas other than those materials that are to be installed the same day. In no case shall material be stored on the existing roof. Any exception must be in written form.

END OF SECTION

SECTION 03 54 16

HYDRAULIC CEMENT UNDERLAYMENT

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide liquid-applied self-leveling floor underlayment for resilient tile installation.
      a. Use hydraulic cement underlayment for application below interior floor coverings.

C. Related Work:
   01 Section 03 30 00 – Cast-In-Place Concrete
   02 Section 09 65 19.1 – Resilient Tile Flooring (Linoleum)
   03 Section 09 65 19.2 – Resilient Tile Flooring (LVT)

1.2 SUBMITTALS

A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
   01 Include information on surface preparation, environmental limitations, and installation instructions.

C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show locations where cast underlayment is proposed to be furnished.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

E. Certification:
   01 Provide written certification that the manufacturer has successfully specialized in production of this type of product / work for a minimum of ten (10) years.
   02 Provide written certification from the manufacturer stating the installer is trained and qualified for the installation of the product.
   03 Provide Environmental Product Declaration (EPD).
   04 Provide independent laboratory test report: ASTM C1708 / C1708M-16.

1.3 REFERENCES

A. American Society for Testing Materials (ASTM):
   01 ASTM C109M, Compressive Strength Air-Cure Only.
   02 ASTM C348, Flexural Strength of Hydraulic-Cement Mortars.
   03 ASTM F2170, Relative Humidity in Concrete Floor Slabs Using in situ Probes.
   04 ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

1.4 QUALITY ASSURANCE

A. Installation of the Hydraulic Cement Underlayment must be completed by a factory-trained applicator, using mixing equipment and tools approved by the manufacturer.

B. Product must have a hydraulic cement-based inorganic binder content as the primary binder which includes Portland Cement per ASTM C150: Standard Specification for Portland Cement and other specialty hydraulic cements. Gypsum-based products are not acceptable.

C. Applicator Qualifications: Company specializing in performing the work of this section, and approved by the manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store all products indoors in original unopened packaging. Keep all materials dry and away from direct sun exposure in moderate conditions between temperatures of 50° F to 90° F (10° C to 32° C)

1.6 MOCK-UP

A. Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   01 Prepare mock-up in location designated by Architect.
   02 Area: 6 ft by 6 ft.

B. Mock-up may remain as part of the work.

1.7 FIELD CONDITIONS

A. Do not install underlayment until floor penetrations and peripheral work are complete.
B. Maintain minimum ambient temperatures of 50° F (10° C) 24 hours before, during and 72 hours after installation of underlayment.

1.8 WARRANTY

A. Provide minimum 10-year manufacturer system warranty for LVT installation utilizing all products required per the manufacturer to achieve. Basis of design warranty to be Uzin Utz Classic + 10 warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Design of Hydraulic Cement Underlayment is based on products manufactured by Uzin Utz North America, Inc.

B. The following additional manufacturers are acceptable to provide the work of this Section, provided their proposed systems / products meet or exceed all specified requirements:
   01 Mapei
   02 Sika USA
   03 Or approved equal (submitted for review during bidding / proposal phase only).

2.2 MATERIALS

A. Cementitious Underlayment: Blended cement mix that, when mixed with water in accordance with the manufacturer's directions, will produce a self-leveling underlayment.
   01 UZIN NC 150
      a. Compressive Strength: Minimum 4500 psi (31.03 MPa) after 28 days, tested per ASTM C1708.
      b. Flexural Strength: Minimum 900 psi (6.21 MPa) after 28 days, tested per ASTM C1708.
      c. Thickness: Capable of thicknesses from 1/16" (1.5 mm) to maximum 1" (25mm).
   02 UZIN NC 157
      a. Compressive Strength: Minimum 6000 psi (41.37 MPa) after 28 days, tested per ASTM C1708.
      b. Flexural Strength: Minimum 1100 psi (7.58 MPa) after 28 days, tested per ASTM C1708.
      c. Thickness: Capable of thicknesses from 1/4" (6 mm) to maximum 2" (50 mm).
   03 UZIN NC 170
      a. Compressive Strength: Minimum 6000 psi (41.37 MPa) after 28 days, tested per ASTM C1708.
      b. Flexural Strength: Minimum 1000 psi (6.89 MPa) after 28 days, tested per ASTM C1708.
      c. Thickness: Capable of thicknesses from 1/16" (1.5 mm) to maximum NO DEPTH LIMITATION (mm).
   04 UZIN NC 172
      a. Compressive Strength: Minimum 8000 psi (55.16 MPa) after 28 days, tested per ASTM C1708. (24-hour compressive strength of 4500 psi (31.03 MPa.)
      b. Flexural Strength: Minimum 1800 psi (12.41 MPa) after 28 days, tested per ASTM C1708.
      c. Thickness: Capable of thicknesses from 1/16" (1.5 mm) to maximum NO DEPTH LIMITATION (mm).
   05 UZIN NC 144 LW
      a. Compressive Strength: Minimum 3000 psi (20.68 MPa) after 28 days, tested per ASTM C1708.
      b. Flexural Strength: Minimum 600 psi (4.14 MPa) after 28 days, tested per ASTM C1708.
      c. Thickness: Capable of thicknesses from 1/4" (6 mm) to maximum 2" (50 mm).
      d. Lightweight: Dry Density of 67.0 ±2 lbs./ft³ (1.40 lbs./ft² at 1/4").

B. Low Emitting

01 VOC content: 0g/L. Compliant with SCAQMD rule 1113.
02 Certified: SCS Indoor Advantage Gold

C. Water: Potable and not detrimental to underlayment mix materials.

2.3 MIXING

A. Site mix materials in accordance with manufacturer's instructions.

B. Mix to self-leveling consistency without over-watering.

2.4 ACCESSORIES

A. Primer:
01 Gypsum Concrete: Two coat application of UZIN PE 260 Primer (diluted to absorbency requirement to seal substrate).
02 Standard Absorbent Concrete: UZIN PE 260 Primer (diluted to absorbency requirement to seal substrate).
03 Extremely Absorbent Concrete: Two coat application of UZIN PE 260 Primer (diluted to absorbency requirement to seal substrate).
04 Wood: UZIN PE 260 Primer (undiluted).
05 Metal: UZIN PE 414 or PE 460 (seek technical guidance before proceeding).
06 Other Non-Porous Substrates: UZIN PE 280 Primer.

B. Joint Filler:
01 Low-odor, 2-component, semi-rigid, polyurea joint filler: UZIN KR 518.

C. Reinforcing Fibers: Can be used to improve impact resistance and control shrinkage of any UZIN self-leveling compound when used on demanding surfaces. Reduces cracking of the leveling compound when used on unsound substrates.
01 Substrate Reinforcing Fibers – UZIN Bagged Fiber.
02 Substrate Reinforcing Mesh (Sheets) – UZIN RR 201.

D. Adhesive:
01 Provide UZIN adhesive as required to achieve system warranty based on final system products needed to achieve the noted installation warranty type.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are clean, dry, unfrozen, do not contain petroleum byproducts, or other compounds detrimental to underlayment material bond to substrate.

B. Moisture Testing: Perform testing according to ASTM F2170. Provide 3 tests for the first 1,000 sq.ft. of floor area plus 1 additional test for each 1,000 sq.ft. thereafter.
01 Relative Humidity Test: Using in situ probes, follow ASTM F2170. Proceed with installation only if the substrate is within spec of the underlayment, adhesive, and finished floor covering manufacturers' limitations.
02 For concrete substrates with high residual moisture, notify owner, owner's rep and manufacturer for recommended preparation to achieve system installation warranty

3.2 PREPARATION

A. Remove substrate surface irregularities. Fill voids and deck joints with filler. Finish smooth.

B. Vacuum clean surfaces.

C. Prime substrate in accordance with manufacturer's instructions. Allow to dry.

D. Close floor openings.

3.3 APPLICATION

A. Install underlayment in accordance with manufacturer's instructions. Always refer to the most current product information at us.uzin.com.

B. Pump or pour material onto substrate. Do not retemper or add water.
   01 Pump, move, and screed while the material is still highly flowable.
   02 Be careful not to create cold joints.
   03 Wear spiked shoes while working in the wet material to avoid leaving marks.

C. Place to indicated thickness, with top surface level to 1/8 inch in 10 ft (1:1000).

D. If a fine, feathered edge is desired, steel trowel the edge after initial set, but before it is completely hard.

3.4 CURING

A. Once underlayment starts to set, prohibit foot traffic until final set has been reached.

3.5 PROTECTION

A. Protect against direct sunlight, heat, and wind; prevent rapid drying to avoid shrinkage and cracking.

B. Do not permit traffic over unprotected floor underlayment surfaces.

END OF SECTION

SECTION 03 54 17

SELF-LEVELING FLOOR UNDERLAYMENT

CONDITIONS OF THE CONTRACT, SUPPLEMENTARY CONDITIONS AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers and Section AF – Subcontractor / Manufacturer Prequalification for substitutions.

B. Provide Self-Leveling Portland cement-based underlayment for use over concealed unknown concrete finishes. Contractor shall include a total equivalent of one hundred (100) bags material and labor to be installed in base bid.
   01 For resilient tile flooring, reference section 03 54 16 to maintain flooring warranty.

C. Sloped application where indicated

D. Related Work:
   01 Floor Finishes, Division 9

1.2 SUBMITTALS

A. Provide all submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Shop Drawings: Within four weeks of award of contract, submit:
   01 Manufacturer’s specifications and other data needed to prove compliance with the specified requirements.
   02 Manufacturer’s installation instructions.

1.3 QUALITY ASSURANCE

A. Installation of Self-Leveling Portland cement-based underlayment must be by an applicator using mixing equipment and tools approved by the manufacturer.

B. Underlayment shall be able to be installed from 1/8 inch to 1-1/2 inch in one pour and up to 5 inches with the addition of aggregate. It may also be feathered to match existing elevations.

C. Underlayment to be applied to a minimum thickness of 1/8 inch over highest point in the subfloor, with an average typical thickness of 1/4 inch.

D. Underlayment compressive strength shall be 4,100 psi after 28 days in accordance with ASTM C109/mod (air cure only).

E. Underlayment shall be walkable after 2 hours and allow floor covering to be installed after 16 hours at 70 degrees F.

F. Manufacturer's certification that the product is Portland cement-based having an inorganic binder content which is a minimum 80 percent Portland cement when tested in accordance with ASTM C150: Standard Specification for Portland Cement.

G. Qualifications

01 Installer Qualifications: All work in this section shall be performed by a factory trained applicator with minimum five years experience in the installation of cementitious underlayment material.

02 Manufacturer Qualifications: Obtain required products from a single manufacturer specializing in the production of products of this type for not less than 20 Years.

03 Manufacturer to provide confirmation installation procedures.

H. Field Samples

01 Prior to the installation of work place field sample of underlayment material at a location directed by or acceptable to the architect.

a. Minimum size – 4'-0" by 4'-0".
b. Show featheredge condition
c. Accepted sample may remain as part of work as directed by architect, rejected samples must be demolished and removed from site.

I. Allowable Tolerances

01 Variation from level: Do not exceed 1/8 inch in any bay or 10 feet in distance.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in their unopened packages and protect from extreme temperatures and moisture. Protect liquids from freezing.

1.5 SITE CONDITIONS

A. The product is a cementitious material. Observe the basic rules of concrete work. Do not install below 50 degrees F surface temperature. Install quickly if floor is warm and follow hot weather precautions available from the manufacturer's Technical Service Department. Never mix with cement or additives other than the manufacturer's approved products.

B. Do not proceed with installation until temperature and relative humidity have been stabilized and been maintained within values established by the manufacturer for optimum quality control.

C. Provide adequate ventilation to prevent accumulation of hazardous fumes during application of components in enclosed spaces, and maintain ventilation until materials have thoroughly cured.

1.6 WARRANTY

A. Minimum Warranty – 5 year product and installation.

PART 2 - PRODUCTS

2.1 APPROVED PRODUCT/MANUFACTURER

A. Product for level applications: ARDEX K-15 Self-Leveling Underlayment Concrete manufactured by ARDEX ENGINEERED CEMENTS Aliquippa, PA; (724) 203-5000. No substitutions.

B. Product for sloped applications: ARDEX SD-P, Self-Drying Patch manufactured by ARDEX ENGINEERED CEMENTS Aliquippa, PA; (724) 203-5000. No substitutions.

C. Primer for standard absorbent concrete shall be ARDEX P-51 Primer.

D. Primer for non-porous subfloors, cutback and other non-water soluble adhesive residues, metal, and wooden subfloors shall be ARDEX P-82 Ultra Prime.

E. The additive to be mixed with ARDEX K-15 when used over cutback adhesive, other non- water soluble adhesives, metal, or wooden subfloors shall be ARDEX E-25 Resilient Emulsion.

F. Aggregate shall be well graded, washed gravel (1/8 inch to 1/4 inch or larger) for use when underlayment is installed over 1-1/2 inches thick.

G. Water shall be clean, potable, and sufficiently cool (not warmer than 70°F).

2.2 MIX DESIGNS

A. Standard mixing ratio: ARDEX K-15 is mixed in 2-bag batches at one time. Mix each bag of ARDEX K-15 (55 lb.) with 7 quarts of water. Product shall be mixed in an ARDEX T-10 Mixing Drum using an ARDEX T-1 Mixing Paddle and a 1/2 inch heavy-duty drill (min. 650 rpm). Mix thoroughly for approximately 2-3 minutes to obtain a lump-free mixture. Follow written instructions per the ARDEX K-15 bag label.

B. Resilient mix for applications over cutback and non-water soluble adhesive residues, wood, and metal: Use 6 qt. of water and 2 qt. of ARDEX E-25 Resilient Emulsion for each bag of ARDEX K-15.

C. Aggregate mix: For areas to be installed over 1-1/2 inches thick, aggregate may be added to reduce material costs. Mix ARDEX K-15 with water first, then add from 1/3 up to 1 part by volume of aggregate (1/8 inch to 1/4 inch or larger). Do not use sand.

D. For pump installations, ARDEX K-15 shall be mixed using an ARDEX Levelcraft Automatic Mixing Pump. Start the pump at 210 gallons of water per hour, and then adjust to the minimum water reading that still allows self-leveling properties. Do not over-water. Check the consistency of the product on the floor to ensure a uniform distribution of the sand aggregate at both the top surface and bottom of the pour. If settling is occurring, reduce the water amount and recheck. Conditions during the installation, such as variations in water, powder, substrate, and ambient temperature, require that the water setting be monitored and adjusted carefully to avoid over watering.

PART 3 - EXECUTION

3.1 PREPARATION

A. All subfloors must be sound, solid, clean, and primed:

01 All concrete subfloors must be of adequate strength, clean, and free of all oil, grease, dirt, curing compounds and any substance that might act as a bond breaker before priming. Mechanically clean if necessary using shot blasting
or other. Acid etching and the use of sweeping compounds and solvents are not
acceptable.

02 Wooden subfloors must be clean and free of all foreign matter. Sand to bare wood then vacuum to remove all dust. Re-nail any loose boards exhibiting movement.
03 Metal subfloors must be clean and free of all rust and foreign matter. Where required, a corrosive resistant coating should be applied and allowed to dry before priming.
04 Cutback and other non-water soluble adhesive residues must be wet scraped to a thin, well-bonded layer.
05 Non-porous subfloors such as ceramic and quarry tile as well as terrazzo should be clean and free of all waxes and sealers. If necessary, have the surface professionally cleaned.
06 All cracks in the subfloor shall be repaired to minimize telegraphing through the underlayment.
07 Substrates shall be inspected and corrected for moisture or any other conditions that could affect the performance of the underlayment or the finished floor covering.

B. Joint Preparation:
01 Moving Joints - honor all expansion and isolation joints up through the underlayment.
02 Saw Cuts and Control Joints - fill all non-moving joints with ARDEX SD-F Feather
Finish or ARDEX SD-P InstantPatch, as required.

C. Priming:
01 Primer for standard absorbent concrete subfloors: Mix ARDEX P-51 1:1 with water and apply evenly with a soft push broom. Do not leave any bare spots. Remove all puddles and excess primer. Allow to dry to a clear, thin film (min. 3 hours, max. 24 hours). Underlayment shall not be applied until the primer is dry. Primer coverage is approximately 400 to 600 sq. ft. per gallon.
02 Primer for extremely absorbent concrete subfloors: Make an initial application of ARDEX P-51mixed with 3 parts water using a soft push broom. Do not leave any bare spots. Remove all puddles and excess primer. Allow to dry thoroughly before proceeding with the standard application of primer as described above for standard absorbent concrete.
03 Primer for non-porous subfloors, wooden or metal subfloors, or cutback and other non-water soluble adhesive residues over concrete: Prime with ARDEX P-82 Ultra Prime. Mix Part A (red) with Part B (white) and apply with a short-nap or sponge paint roller, leaving a thin coat of primer no heavier than a thin coat of paint. Do not leave any bare spots. Remove all puddles and excess primer. Allow to dry to a clear, slightly tack film (minimum 3 hours, maximum 24 hours). Underlayment shall not be installed until primer is dry. Primer coverage is approximately 200 to 400 square feet per gallon.
04 Minimum drying time for ARDEX P-82 Ultra-Prime over cutback adhesive is 18 hours.

3.2 APPLICATION OF UNDERLAYMENT

A. Installation:
01 Wooden subfloors require the use of the mesh-reinforced ARDEX K-15 + E-25 Underlayment System. After priming, install 3.2 or 3.4 galvanized diamond metal lath by stapling to the wooden subfloor approximately every 6 inches on center.
02 Steel subfloors require that the substrate first be primed with an anti-corrosive paint. After thorough drying of the paint, prime this surface with ARDEX P-82 Ultra Prime.

03 Pour or pump the liquid ARDEX K-15 and spread in place with the ARDEX T-4 Spreader. Use the ARDEX T-5 Smoother for featheredge and touch-up. Wear baseball or soccer shoes with non-metallic cleats to avoid leaving marks in the liquid ARDEX K-15. Underlayment can be walked on in 2-3 hours at 70 degrees F.

04 Ten bags is for use with the owner's prior approval and not to be used due to poor workmanship associated with this contract. Save used bags for observation and verification by the architect.

3.3 PREPARATION FOR FLOORING INSTALLATION

A. Underlayment can accept finish floor covering materials after 16 hours at 70 degrees F and 50 percent relative humidity.

B. Due to the wide range of adhesives that are used to install floor coverings, some adhesives may dry more quickly over Ardex underlayments than over other substrates. If this condition occurs, priming the surface of the underlayment with ARDEX P-51 Primer diluted 1:3 with water will even out the drying of the adhesive. Allow the primer to dry 1-3 hours before proceeding with the adhesive installation.

3.4 FIELD QUALITY CONTROL

A. Where specified, field sampling of the Ardex underlayment is to be done by taking an entire unopened bag of the product being installed to an independent testing facility to perform compressive strength testing in accordance with ASTM C 109/modified: air-cure only. There are no in situ test procedures for the evaluation of compressive strength.

END OF SECTION

SECTION 04 20 00

UNIT MASONRY

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide all concrete masonry unit (CMU) masonry work where indicated on the Drawings and as required for a complete installation.
   02 Provide all face brick masonry work where indicated on the Drawings and as required for a complete installation.
   03 Provide all masonry reinforcing and ties as specified here-in; and required for a complete installation.
   04 Provide water repellant application to exterior veneer masonry.

C. Related Work:
   01 Section 04 23 00 – Glass Unit Masonry.
   02 Section 04 72 00 – Cast Stone Masonry.
   03 Section 07 25 00 – Weather Barrier
   04 Section 07 92 00 – Joint Sealants

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Samples:
   01 Each type of face brick proposed to be furnished in quantities sufficient to show range of color where applicable.
   02 Samples of brick ties proposed to be furnished.
   03 Samples of full range of actual mortar color selections. Paper or digital samples are not acceptable.
   04 Sample of mortar deflector proposed to be furnished.

D. Sample panel: Sample panel shall be 8' long min. x 6' high panel showing selected face brick color range and texture, bonding, mortar color, joint shape, and quality workmanship.
   01 Panel shall be "L" shaped (4' min. x 6') with metal stud / drywall back-up wall on one side and CMU back-up on one side. Coordinate as required with other trades. Include window frame mock-up in each panel.

02 Include a brick expansion joint. Sample panel shall remain at the jobsite until all masonry is completed.
03 Panel shall include all masonry systems used on the building.
04 Once accepted by the Architect and the Owner, the sample panel shall be the standard by which installed CMU and face brick masonry shall be judged.
05 Sample wall shall remain in place until all masonry work is complete.

E. Operations and Maintenance Manuals
01 Provide complete operations and maintenance manuals to the Owner.
02 Refer to section 01 78 23 – Operations and Maintenance Manuals
03 O & M manuals must be reviewed, accepted and delivered to the Owner prior to Owner demonstration(s).

F. For warranties longer than one (1) year, submit a sample of the warranty proposed to be furnished.

1.3 REFERENCES

A. American Society for Testing and Materials:
01 ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
02 ASTM C43 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
03 ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale)
04 ASTM C67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
05 ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units
06 ASTM C216 - Standard Specifications for Facing Brick.
07 ASTM C476 – Standard Specifications for Grout for Masonry.
08 ASTM C652 - Standard Specification for Hollow Brick (Hollow Masonry Units Made From Clay or Shale)
09 ASTM C744 - Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units.
10 ASTM C140 - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
11 ASTM D5095 - Standard Test Method for Determination of the Nonvolatile Content in Silanes, Siloxanes and Silane-Siloxane Blends Used in Masonry Water Repellent Treatment
12 ASTM D6490 – Standard Test Method for Water Vapor Transmission of Non-Film Forming Treatments Used on Cementitious Panels
13 ASTM D6532 – Standard Test Method for Evaluation of the Effect of Clear Water Repellent Treatments on Water Absorption of Hydraulic Cement Mortar Specimens

B. Brick Industry Association (BIA).

C. National Concrete Masonry Association (NCMA).

D. National Fire Protection Association (NFPA) 285 – Standard Fire Test Methods for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Materials.

1.4 TESTS AND INSPECTIONS

A. Architect may require tests and inspections as necessary to verify quality and strength of brick materials, mortar, grout, and workmanship.
   01 Material tests shall be made on actual materials as they are being installed on the project.
   02 Contractor shall coordinate and cooperate with testing lab as required for tests to be conducted.

B. Laboratory tests of materials, mortar, grout and prisms shall be made per ASTM standard procedures.

C. Contractor shall coordinate with testing lab as required to provide the necessary materials and samples.

D. Owner will select Testing Laboratory and Owner will pay for all work required by Testing Laboratory.

1.5 DELIVERY, STORAGE AND PROTECTION

A. Store all materials above the ground to prevent contamination by dirt, rust or other materials which may cause staining or other blemishes and defects.

B. Store concrete and clay masonry units under cover and keep dry until used for installation.

C. Store in manufacturer's original containers until opened for installation.

D. Cementitious materials or admixtures in opened / broken containers or in packaging showing water marks or evidence of other damage shall be removed from the site and not used for installation.

E. Bulk sand used for mixing mortar shall be placed on a waterproof membrane sufficient to prevent intrusion of ground water into the sand; and similarly, shall be covered as required to prevent intrusion of water / rain.

1.6 SITE CONDITIONS

A. Cold Weather Protection: No masonry shall be laid when the temperature of the outside air is below 40° F, unless protection measures are employed and pre-approved by the Architect.

B. Protection measures for cold weather erection include maintaining space and masonry unit temperatures of at least 40° F for 48 hours, prior to and after erection.

1.7 WARRANTY

A. Warrant the masonry work specified herein for two (2) years after Substantial Completion against becoming unserviceable or causing an objectionable appearance, resulting from either defective or nonconforming materials or workmanship.

B. Defects shall include, but not be limited to the following:
   01 Noticeable deterioration of masonry unit or mortar finish.

02 Chalking or dusting excessively.
03 Changing sheen in irregular fashion.
04 Efflorescence.

C. Warrant the masonry water repellant work specified herein for five (5) years after Substantial Completion against becoming unserviceable or causing an objectionable appearance, resulting from either defective or nonconforming materials or workmanship.

1.8 PRE-INSTALLATION CONFERENCE

A. Refer to Section 01 31 19 – Project Meetings

B. Required attendees shall include, but is not limited to:
01 Contractor's Superintendent(s)
02 Contractor's Project Manager(s)
03 Subcontractor's Foreman
04 Architect's Representative
05 Owner or Owner's Representative
06 Material Testing Lab's Representative

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers - Concrete Masonry Units – CMU: design is based on products manufactured by Best Block Company.
01 Acceptable Manufacturers: the following manufacturers are acceptable to provide products of this section provided proposed products meet or exceed all specified requirements.
a. Featherlite.
b. Revels Block & Brick Co.
c. IPC.

B. Acceptable Manufacturers – Split-Face Masonry Units: design is based on products manufactured by Best Block Company.
01 Acceptable Manufacturers: the following manufacturers are acceptable to provide products of this section provided proposed products meet or exceed all specified requirements.
a. Oldcastle / Trenwyth.
b. Acme.

C. Acceptable Manufacturers - Face Brick: design is based on products manufactured by Acme Brick.

D. Acceptable Manufacturers - Structural Glazed Tile Base: design is based on products manufactured by Spectra Industries, Inc..
01 Acceptable Manufacturers: the following manufacturers are acceptable to provide products of this section provided proposed products meet or exceed all specified requirements. Color must match that specified.
a. Elgin Butler

E. Masonry Reinforcement, Anchors and Ties: design is based on products manufactured by Hohmann &Barnard (HB).

01 Acceptable Manufacturers: the following manufacturers are acceptable to provide products of this section provided proposed products meet or exceed all specified requirements.
a. Heckmann Building Products (basis of design).
b. Dayton Superior / Dur-O-Wal.
c. Wire-Bond.

F. Mortar Dropping Deflector: design is based on products manufactured by Mortar Net.
01 Acceptable Manufacturers: the following manufacturers are acceptable to provide products of this section provided proposed products meet or exceed all specified requirements.
a. Hohmann &Barnard (HB) .
b. Heckman.
c. Polyguard Products.

G. Weep Hole Inserts: design is based on products manufactured by Hohmann & Barnard (HB).
01 Acceptable Manufacturers: the following manufacturers are acceptable to provide products of this section provided proposed products meet or exceed all specified requirements.
a. Heckman Building Products.
b. Advanced Building Products.
c. Wire Bond.

H. Masonry Cleaning Products: design is based on products manufactured by Prosoco.
01 Acceptable Manufacturers: the following manufacturers are acceptable to provide products of this section provided proposed products meet or exceed all specified requirements.
a. Diedrich Technologies.
b. Dumond Chemicals.
c. CBR Products.

I. Masonry Water Repellants: design is based on products manufactured by Prosoco.
01 Acceptable Manufacturers: the following manufacturers are acceptable to provide products of this section provided proposed products meet or exceed all specified requirements.
a. Tnemec.
b. United Golsonite Laboratories (UGL).

J.

2.2 MASONRY MATERIALS

A. Masonry Veneer - Face Brick:
01 Size: King Size (2-5/8" x 9-5/8" x 2-3/4").
02 Brick:
a. Brick A (Field): Acme Brick 70% ELP 110 / 30% ELP 112
b. Brick B (Accent): Acme Brick DTP 673 29-121-48-27 Cedar Valley.
03 All face brick shall comply with ASTM C-652, Grade SW, type FBX.
04 Provide solids as required to ensure against exposed cores or unfinished faces or ends.
05 Provide special shapes as indicated on the Drawings.

06 Cut brick as required to meet size requirements shown on drawings and to match existing conditions.

B. Concrete Masonry Units:
01 Face Dimensions: 8" x 16", modular depths (4", 6", 8", 12") as indicated on Drawings.
02 Color shall be standard gray.
03 Comply with ASTM C90.
a. Grade: N, highest standard.
b. Aggregate: Lightweight.
04 When tested as a component of a masonry prism, CMU shall have a minimum compressive strength of 1,900 PSI, or higher if indicated on the structural Drawings.
05 Provide class D-2 units at 2-hour rated walls; class D-3 at 3-hour rated walls.
06 Curing: Rotary kiln process.
07 Provide bullnose units at all outside corners; except at walls to receive ceramic tile finish. Coordinate as required.
08 Complete with bond beam, control joints, jambs, lintels, soaps and fillers to match and compliment standard CMU.

C. Structural Glazed Tile Base:
01 Spectra-Glaze II Factory Glazed Concrete Masonry Units by Spectra Industries, Inc.
02 Nominal: 4" x 4" x 16" to match existing.
03 Colors: Special Black
04 Provide glazed outside corners and tops as required.
05 Provide non-coved base. If a non-coved base cannot be provided, cut unit to nominal size listed above to match existing construction.

2.3 MORTAR MATERIALS

A. Type "S" Mortar:
01 Use at all CMU masonry work.
02 Hydrated Lime: ASTM C207, TYPE "S".
03 Portland Cement: ASTM C150, Type 1.
04 Water: Clean and potable.
05 Sand: ASTM C144.
06 Type "S" Mix Design: (Proportions by volume):
a. Type: ASTM C270, Type "S".
b. Proportions: 1 part cement, 1/2 part hydrated lime and 4-1/2 parts sand to provide a minimum compressive strength of 1800 PSI in 28 days. Maximum compressive strength shall not exceed that of adjoining masonry.
c. Mixing: Thoroughly machine-mix for at least 5 minutes after all material is in mixer.
07 Do not use calcium chloride.

B. Type "N" Mortar:
01 Use at all masonry veneer work.
02 Hydrated Lime: ASTM C207, TYPE "N".
03 Portland Cement: ASTM C150, Type 1.
04 Water: Clean and potable.
05 Sand: ASTM C144.
06 Type "N" Mix Design: (Proportions by volume)

a. Type: ASTM C270, Type “N”.
b. Proportions: 1 part cement, 1 part hydrated lime and 6 parts sand to provide a compressive strength of minimum 750 PSI in 28 days. Maximum compressive strength shall not exceed that of adjoining masonry.
c. Mixing: Thoroughly machine-mix for at least 5 minutes after all material is in mixer.
d. Do not use calcium chloride.

C. Mortar Colors:
01 Provide standard gray mortar for all concealed masonry and masonry to receive a painted finish.
02 Mortar at exposed / unfinished masonry shall be as selected by the Architect from manufacturer’s full range of mortar colors – minimum of 12.

D. Site Mixed Mortar:
01 All site mixed masonry components shall be added to mixer using quantifiable mixing containers (i.e. cubic-foot boxes, known quantity liquid devices and similar containers).
02 Adding components by shovel is not permitted.

E. Mortar Deflector:
01 3-dimensional, polypropylene or polyethylene mesh product designed to be a continuous application at the base of a brick ledge.
02 Deflector shall be dual level to eliminate continuous build-up of mortar on the upper edge.
03 Deflector shall fill the width of the brick cavity up to minus (-) 1/2".
04 Deflector shall be non-corrosive.
05 Provide continuous at base of all brick veneer, brick ledges, lintels and metal through-wall flashing conditions.

F. Weep Hole Inserts:
01 Design is based on HB QV-Quadro Vent Weep Hole Insert.
02 Polypropylene honeycomb unit to be installed at brick veneer weep holes.
03 Must restrict ingress of insects.
04 Conforming to ASTM D2240, D790B, D638 and D1238B.
05 Size to fit the head dimension of the brick unit being used.
06 Unit to be installed flush with the exterior face of the veneer.
07 Color to be selected from manufacturer’s standard finishes.
08 Provide at all weep holes.

2.4 MASONRY REINFORCING MATERIALS

A. General:
01 All masonry reinforcing shall be hot-dipped galvanized after fabrication in accordance with ASTM A153.
02 All truss type reinforcing shall fabricated using be 9 gauge rod materials unless noted / specified otherwise.
03 All truss type reinforcing shall be furnished with prefabricated corners and tees to be used where applicable.
04 All truss type reinforcing shall be provided in nominal widths, 2” less than masonry it is being installed in.

B. Truss Type Reinforcing – Single Wythe Masonry:
   01 Design is based on HB no. 120 Lox-All Truss-Mesh or 220 Ladder-Mesh Joint Reinforcing.
   02 Provide in continuous lengths wherever possible.
   03 Spacing: nominal 16” O.C. vertically.

C. Truss Type Reinforcing – Multiple Wythe CMU Composite Walls:
   01 Design is based on HB no. 140 Lox-All Truss-Mesh or 240 Ladder-Mesh Joint Reinforcing.
   02 Provide in continuous lengths wherever possible.
   03 Spacing: nominal 16” O.C. vertically.

D. Truss Type Reinforcing – CMU Back-Up Walls With Brick Veneer:
   01 Design is based on HB no. 170 Lox-All Truss Style Adjustable Joint Reinforcement.
   02 Provide with 3/16” Eyes and Pintles.
   03 Provide pintle length / size as required to extend to 3/4" to 1” from outside face of masonry veneer.
   04 Pintles shall allow for a minimum of 1-1/4” vertical adjustment. Provide in greater adjustment configuration where required due to masonry coursing.
   05 Provide in continuous lengths in horizontal joints.
   06 Spacing: nominal 16” O.C. vertically; eyes and pintles at 16” O.C. horizontally.

E. Masonry Ties – Veneer at Metal Stud Back-Up Walls – With Rigid Insulation:
   01 Design is based on HB no. HB-213 series 2-Piece Adjustable Anchors.
   02 L-shaped plate bracket; 12 gauge material.
   03 Provide with 3/16” pintles.
   04 Provide pintle length / size as required to extend to 3/4" to 1” from outside face of masonry veneer.
   05 Pintles shall allow for a minimum of 1-1/4” vertical adjustment. Provide in greater adjustment configuration where required due to masonry coursing.
   06 Spacing: nominal 16” O.C. vertically; and 16” O.C. horizontally.

F. Masonry Ties – Veneer at Metal Stud Back-Up Walls – Without Rigid Insulation:
   01 Design is based on HB no. DW-10HS series 2-Piece Veneer Anchors.
   02 Slotted, 5-1/2” long plate bracket; 12 gauge material.
   03 Provide with 3/16” triangular wire tie.
   04 Provide wire tie length / size as required to extend to 3/4" to 1” from outside face of masonry veneer.
   05 Pintles shall allow for a minimum of 1-1/4” vertical adjustment. Provide in greater adjustment configuration where required due to masonry coursing.
   06 Spacing: nominal 16” O.C. vertically; and 16” O.C. horizontally.

G. Masonry Ties – Steel:
   01 Design is based on HB series 359 2-piece anchors welded to steel structure / components.
   02 Provide with 3/16” triangular wire tie.
   03 Provide wire tie length / size as required to extend to 3/4" to 1” from outside face of masonry veneer.

04 Pintles shall allow for a minimum of 1-1/4” vertical adjustment. Provide in greater adjustment configuration where required due to masonry coursing.
05 Spacing: nominal 16” O.C. vertically; and 16” O.C. horizontally.

H. Control Joint Anchors:
01 Masonry Veneer Control Joints: design is based on HB Corrugated Control Joint Anchor. Size: 1/2" x 16 gauge.
02 CMU Wall Control Joints: design is based on HB Slip-Set Stabilizer, 2-piece anchor comprised of metal end with two integral 9 gauge rods and a 4” long PVC loose sleeve.

I. Cast Stone Anchors:
01 Design is based on HB no. 309 and no. 309-H or similar anchor as recommended by the cast stone manufacturer.
02 Coordinate as required for proper type and quantities.

J. All fasteners used to connect masonry ties and similar products through the weather barrier shall be cadmium plated and provided with neoprene washers.

2.5 CMU MASONRY REINFORCING

A. All reinforced CMU masonry reinforced with grade 60 rebar and cells filled with grout.
01 Grout shall meet or exceed requirements of ASTM C476.
02 Grout shall be a blend of cement, sand, aggregate and water required to create a flowable mixture.
03 Grout compressive strength shall be a minimum of 2,000 PSI at 28 days.
04 Use at all vertical reinforced cells, hollow metal doors frames, bond beams, lintels and other locations indicated on the Drawings or required for a complete masonry installation.
05 Refer to structural Drawings for additional information and requirements.

B. Coordinate as required for installation of rebar dowels set in concrete foundation to connect to all CMU vertical reinforced cells.
01 Unless noted otherwise, rebar dowels for 8” or larger CMU shall be #5 rebar, 30” in length, embedded nominally 12” into concrete foundation.
02 Unless noted otherwise, rebar dowels for 6” CMU shall be #4 rebar, 30” in length, embedded nominally 12” into concrete foundation.
03 Reinforcing shall be continuous from slab to top of wall. Splice in accordance with section 03 30 00.
04 Vertical reinforcing shall tie to reinforcing at bond beams and lintels.

C. Unless noted more stringent on the structural Drawings, provide reinforcing in vertical CMU cells at the following locations:
01 General Field / Run of Walls: 48” O.C. maximum.
02 End of Walls: at end cell.
03 Wall Corners: at corner cell and adjacent cell each side.
04 Wall Intersections: two cells at intersection (one each wall).
05 Openings: at one cell each side of opening.
06 Expansion / Control Joints: at one cell each side of joint.
07 Refer to structural Drawings for additional information.

D. CMU Lintels:
   01 At 6” CMU Lintels: (1) #4 bar and fill with pea gravel concrete or grout.
   02 At 8” CMU Lintels: (1) # 5 bar at 8” / (2) #5 bars at 16” and fill with pea gravel concrete or grout.
   03 At 12” CMU Lintels: (2) # 5 bars and fill with pea gravel concrete or grout.
   04 Lintels shall extend a minimum of 8” beyond openings and tied to vertical cell reinforcing at jambs.

E. CMU Bond Beams:
   01 Provide continuous CMU bond beams at top of, or last full accessible course of all CMU walls.
   02 On walls heights 14’ or taller, provide a bond beam at the mid-point of the wall.
   03 Bond beam reinforcing shall be as described for CMU lintels above.
   04 Bond beams shall be tied to vertical cell reinforcing.
   05 Refer to structural Drawings for mechanical linkage between CMU walls and steel structure.

2.6 MASONRY CLEANING AND PROTECTION

A. Masonry Cleaning Products:
   01 Cleaning materials for the purpose of removing excess mortar, job dirt and normal job stains from light colored brick and tile units which are not subject to metallic stains shall be Sure Klean® 600 Detergent manufactured by Prosoco; or approved equal.
      a. Specific Gravity: 1.117.
      b. pH: 0.3 (1:6 dilution).
      c. Flash Point: None.
      d. Freeze Point: -30° F (-34.4° C).
      e. Weight/Gal.: 9.3 lbs.
   02 Cleaning materials for purposes of removing excess mortar, job dirt and normal job stains from brick and tile units which are subject to metallic oxidation stains shall be Sure Klean® Vana Trol® manufactured by Prosoco Co.; or approved equal.
      a. Specific Gravity: 1.117.
      b. pH: 0.3 (1:6 dilution).
      c. Flash Point: None.
      d. Freeze Point: -30° F (-34.4° C).
      e. Weight/Gal.: 9.3 lbs.
   03 Cleaning material for removal of excess mortar and job dirt from brick, concrete, tile and stone surfaces shall be Enviro Klean® Mortar & Grout Remover manufactured by Prosoco Co.; or approved equal.
      a. Flash Point: None.
      b. Specific Gravity: 1.00.
      c. pH: 1.6 (dilute 1 pound of powder to 1 gallon of water).

   04 Consult brick supplier/manufacturer to confirm proper selection of cleaning detergent to minimize reaction from metallic or other mineral deposits.

B. Masonry Water Repellant Sealant:
   01 Design is based on Prosoco Sure Klean® Weather Seal Siloxane PD.
      a. Solids: 4.0% ASTM D5095.

b. Specific gravity: 0.996.
c. Flash point: > 212 degrees f per ASTM D3278.
d. VOC: <30 grams/liter.

02 Water Absorption Reduction Rates:
a. Mortar: 98% minimum per ASTM D6532
b. Brick: 89% minimum per ASTM C67
c. CMU: 95% minimum ASTM C140

PART 3 - EXECUTION

3.1 PREPARATION OF MATERIALS

A. Concrete Masonry Units
01 Lay out CMU to coordinate with reinforcing dowels in slab, centered in CMU vertical cells.
02 Where cutting is required, masonry shall be cut with a sharp masonry saw.
03 Lay out split face masonry to yield a generally uniform appearance, without extreme variations from unit to unit.
04 Lay out CMU to eliminate installation of small cuts as much as practical.

B. Brickwork:
01 Dampen brick before laying in a manner consistent with the nature of the brick, the mortar, and the weather conditions.
02 Lay out masonry to eliminate installation of small cuts as much as practical.

C. Mortar and Grout:
01 Use suitable containers for material measurement (i.e. metal or wood cubic foot box, graduated bucket, etc.). Measuring sand with a shovel is not acceptable.
02 Mix a minimum of 5 minutes.
03 Consistency will completely fill all spaces intended to receive grout.
04 Use within 2-1/2 hours of initial mixing.
05 Mortar or grout shall not be used if curing has progressed to yield a stiff consistency or flash set.

D. Reinforcement:
01 Reinforcement shall be free from lose rust and other coatings that would reduce the bond.
02 Cut accurately to length and bend by such methods as will prevent injury to the material.

E. Straighten out kinks or bends.

3.2 ALLOWABLE TOLERANCES

A. Maximum Variation from Plumb:
01 In lines and surfaces of columns, walls and at rises:
a. 1/4" in 10' (1:480).
b. 3/8" in 20' (maximum).
c. 1/2" in 40' (1:960).
02 For external corners, expansion joints and other conspicuous lines:
a. 1/4" in 20' (maximum).

b. 1/2" in 40' (1:960).

B. Maximum variation from level:
01 1/4" in any 20' (1:480).
02 1/2" in any 40' (1:960).

3.3 INSTALLATION

A. Contractor shall use all means necessary to ensure all masonry work is adequately braced at all times during erection.

B. General:
01 Do not use chipped brick or chipped block where exposed to view.
02 Use masonry saws to cut and fit exposed units.
03 Lay units plumb, true to line, and with level courses accurately spaced within allowable tolerances.
04 Do not furrow bed joints.
05 Stop off horizontal run by racking back in each course; toothing is not permitted.
06 Adjust units to final position while mortar is soft and plastic.
07 If units are displaced after mortar has stiffened, remove, clean joints and units and re-lay with fresh motor.
08 When joining fresh masonry to set or partially set masonry:
a. Remove loose masonry units and mortar.
b. Clean and lightly wet exposed surface of set masonry prior to laying fresh mortar.

C. Metal Door Frames Anchored to Masonry: Fill jamb frames solid with mortar as work progresses. Install masonry anchors, securing to frame and adjacent vertical reinforcement. Fill head frame solid with mortar prior to installing lintel units.

D. Lintels and Bond Beams: Provide reinforced unit type, except where steel lintels are shown. Use reinforcing bars as shown on the drawings. Completely fill lintels and bond beams with pea-gravel concrete,. Provide 8 inch bearing at end of lintels.

E. Partitions Tops: Allow space at top of horizontal spanning walls for compressible joint back-up and sealant as specified in Sealant section. Anchor top of walls to deck or structure.

F. Flashing, moisture and vapor barriers at windows systems shall be installed prior to the brick veneer or use of a weathering flange to tie flashing into window system is permitted.

G. Brick Ledge and Through Wall Flashing:
01 Clean surface of masonry smooth and free from projections which might puncture or otherwise damage flashing material.
02 Place through-wall flashing on bed of mortar and cover with mortar.

H. Mortar Beds:
01 Place mortar in a manner which will result in the development of adequate bond between the masonry and the reinforcement.
02 Lay units with full mortar coverage on horizontal and vertical / head joints in all courses.

03 Provide sufficient mortar on ends of masonry unit to fill head joints.
04 Rock closures into place with head joints thrown against two adjacent masonry units in place.
05 Do not pound corners or jambs to fit stretcher units after setting in place.
06 Where adjustment to corners or jambs must be made after mortar has started to set, remove mortar and replace with fresh mortar.

I. Weepholes:
01 Provide weepholes in head joints in course immediately above all thru-wall and self-adhered flashing at all exterior brick walls.
02 Leave head joint free and clean of mortar.
03 Spacing:
a. Modular Brick and Stone: 24 inch O.C. maximum.
b. King Size Brick: 30 inch O.C. maximum.
c. CMU: 32 inch O.C. maximum.
04 Keep weepholes and area at flashing free of mortar droppings.
05 Install weep hole inserts at all weep hole head joints.

J. Cavity:
01 The level to which brick cavities shall be free of excess mortar shall be as established and approved on the masonry mock-up wall. Keep masonry cavity clean and free of excess mortar.
02 Carefully lay first course at brick ledge and lintels, making sure that cavity is clean of all excess mortar which my impede the flow of moisture through weep holes.
03 As work progresses, trowel and remove all protruding fins in cavity flat on inner surface of the wythe brick cavity.
04 Take all necessary precaution to not allow excess mortar to drop within cavity from the inner surface of the wythe.
a. Use wood strips with attached wire pulls or other suitable means to collect all loose mortar below the course being laid.
b. Remove all mortar and clean the device at regular intervals while mortar is still elastic and able to be removed without disturbing masonry already laid above it.
05 Cavities shall be inspected and excess mortar within the masonry cavity shall be grounds for removal and replacement of masonry if no other practical means is available to remove excess mortar; all at contractor's expense.

K. Mortar Joints and Patterns:
01 Refer to drawings for accent coursing.
02 Lay brick in one-third running bond pattern as required to match existing, adjacent construction.
03 Lay standard CMU in one-half running or stack bond pattern as required ot match existing, adjacent construciton.
04 Provide flush joints where concealed from view and where dampproofing is scheduled.
05 Provide standard concave tooled joint where masonry is exposed to view for brick and CMU, typically. Provide recessed accent joints in brick where indicated on elevations.
06 All mortar joints to be of consistent size.
07 Refer to the drawings for paver patterns.

L. Reinforcement/Tie Systems:

01 Completely embedded in mortar or grout.
02 All reinforcement consisting of bars or wire 1/4 inch or less in diameter, embedded in the horizontal mortar joints, shall have no less than 5/8 inch mortar coverage from the exposed face.
03 Truss reinforcing within each wythe shall be at 16 inch O.C. vertically for exterior wythes and back-up wythes, whether detailed or not.
04 Veneer anchors at sheathing covered metal stud exterior walls shall be attached on outside face of sheathing using cadmium plated sheet metal screws. Spacing shall be 16 inch O.C. horizontally and 16 inch O.C. vertically.
05 Veneer anchors at Interior brick walls with metal stud back up shall be the same as paragraph "2.4D" above, except anchors shall be attached directly to metal stud with cadmium plated sheet metal screws.
06 At intersection of all perpendicular masonry walls provide two vertical rows of corrugated wall ties at 16 inch O.C. vertically (7/8" wide x 16 gauge galvanized steel).
07 In cavity walls with CMU back up, embed truss type horizontal reinforcement with integral wall ties every 16 inches O.C. vertically.
08 Splices in reinforcement: Splices may be made only at such points and in such manner that the structural strength of the member will not be reduced. Lapped splices shall be 8 inches. Welded or mechanical connection shall develop the strength of the reinforcement.
09 Corrugated strap ties shall not be used as veneer anchors.
10 Place joint reinforcement in the first two bed joints above and the first two bed joints below masonry openings.
11 Provide masonry ties at floor and roof decks as indicated.

M. Corners: Connect corners with No. 9 galvanized wire or corrugated tie using one tie for each 4 inches of nominal wall thickness.

N. Masonry Joints: Expansion Joints/Control Joints:
01 The mortar joint which stops at the expansion joint cavity shall be struck flush with the masonry unit, producing a continuous flat surface for the sealant to adhere to.
02 Place masonry control joints and expansion joints as indicated on the Drawings. If not indicated, place joints at 20’-0” O.C. maximum and at each side of openings. Coordinate with Architect for exact locations.
03 Provide CMU control joints directly over concrete slab control joints. Whenever possible, lay out CMU so that control joint will coincide with CMU module (20’ maximum spacing between control joints).
04 Provide masonry joints at structural columns to isolate movement from continuing or intersecting walls and columns.
05 Joints for expansion and contraction shall be sealed to prevent weather and water from penetrating into the building. Expansion joint caulk shall match the color of the brick it is adjacent to.

O. Sealant Joints:
01 Allow for sealant joints around outside perimeters of exterior doors, window frames and other wall openings.
02 Uniform depth: 3/4 inch
03 Uniform width: not less than 1/4 inch and not more than 1/2 inch.
04 Provide sample for Architects approval.
05 Refers to drawing for locations and details of accent joints.

P. Mortar Deflector:

01 Provide in continuous lengths at base of all masonry installations including brick ledges, lintels and similar conditions where weep holes are present.
02 Install in accordance with manufacturer's standards and requirements.

3.4 CLEANING

A. At completion of the work, fill and retool holes in joints of exposed masonry surfaces with mortar.

B. After pointing has set and hardened, clean exposed masonry surfaces with cleaning agent recommended for each type of masonry used.

C. Leave masonry clean, free of mortar daubs and with tight mortar joint throughout.

D. After brickwork is set, protect all edges and corners from damage.

E. The cleaning shall be in accordance with manufacturers printed instructions for type of cleaning agent used.
01 Use a stiff brush where possible for all cleaning.
02 If a pressure washer is required, use pressure at 300 PSI or less as required to prevent damage of any kind to masonry (i.e. chipping units or mortar, removing brick texture, etc.).
03 Keep tip a minimum of 24" from face of wall being cleaned.

3.5 MASONRY WATER REPELLANT SEALER

A. Upon completion of cleaning all masonry surfaces, apply the masonry water repellant sealant material to all masonry surfaces using a low pressure.

B. Application: Before applying, read "Protect" and "Precautionary Measures" sections in the Manufacturer's Product Data Sheet for Weather Seal Siloxane PD. Refer to the Product Data Sheet for additional information about application of Weather Seal Siloxane PD. Do not dilute or alter.

C. Vertical Application Instructions
01 For best results, apply protective treatment "wet-on-wet" to a visibly dry and absorbent surface.
02 Alternate Application Methods:
a. Spray: Saturate from the bottom up, creating a 4" to 8" (15 to 20 cm) rundown below the spray contact point. Let the first application penetrate for 5-10 minutes. Re-saturate. Less will be needed for the second application.
b. Brush or roller: Saturate uniformly. Let protective treatment penetrate for 5 to 10 minutes. Brush out heavy runs and drips that don't penetrate.
c. Dense Surface Application Instructions: Apply in a single, saturating application with no run down. Back roll all runs and drips to ensure uniform appearance. DO NOT OVER APPLY. One application is normally enough. Always test.
03 Horizontal Application Instructions:
a. Saturate in a single application. Use enough to keep the surface wet for 2 to 3 minutes before penetration.

b. Brush out puddles until they soak in. Treated surfaces dry to touch in 1 hour. C. Protect surfaces from rainfall for 6 hours following treatment. Many surfaces need several days to develop full water repellency.

3.6 PROTECTION

A. Cover over all unfinished work at night against the elements with plastic sheet, building paper, heavy canvas or other material approved by Architect to prevent water from entering masonry cavities.

B. Upon completion of masonry work, use all means necessary to protect the masonry installation from damage. If damaged, immediately make all repairs and / or replacements.

END OF SECTION

SECTION 04 72 00

CAST STONE MASONRY

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide cast stone copings, headers, masonry column caps and / or other shapes as indicated on the Drawings.
   02 Cast stone work shall include all materials, accessories and anchoring devices required for a complete installation.

C. Related Work:
   01 Section 04 20 00 – Unit Masonry

1.2 SUBMITTALS

A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01 Include recommended cleaning products and instructions for use.
   02 Where applicable, provide recommended maintenance schedules and procedures.

F. Color / Finish Samples:
   01 Provide two (2) samples of each finish for selection by the Architect.
   02 Finish samples shall be provided of / on actual material; paper or digital

samples shall not be accepted.

03 Minimum size shall be 6” x 6” but must be large enough to convey attributes of the proposed product.

G. Operations and Maintenance Manuals:

01 Provide complete operations and maintenance manuals to the Owner.

02 Refer to section 01 78 23 – Operations and Maintenance Manuals

03 O & M manuals must be reviewed, accepted and delivered to the Owner prior to Owner demonstration(s).

H. For warranties longer than one (1) year, submit a sample of the warranty proposed to be furnished.

1.3 REFERENCES

A. ASTM International:

01 ASTM C 33 – Standard Specification for Concrete Aggregates.

02 ASTM C 150 - Standard Specification for Portland Cement.

03 ASTM C 595 – Blended Cement.

04 ASTM C 1157 – Hydraulic Cement.

05 ASTM C 173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volume Method.

06 ASTM C 231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

07 ASTM C 260 - Standard Specification for Air-Entrained Admixtures for Concrete.

08 ASTM C 270 - Standard Specification for Mortar for Unit Masonry.

09 ASTM C 426 – Standard Test Method for Linear Shrinkage of Concrete Masonry Units.

10 ASTM C 494/C 494M - Standard Specification for Chemical Admixtures for Concrete.

11 ASTM C 618 – Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.

12 ASTM C 666 – Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.

13 ASTM C 979 - Standard Specification for Coloring Pigments for Integrally Pigmented Concrete.

14 ASTM C 989 – Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete.

15 ASTM C 1116 – Standard Specification for Fiber Reinforced Concrete and Shotcrete.

16 ASTM C 1194 - Standard Test Method for Compressive Strength of Architectural Cast Stone.

17 ASTM C 1195 - Standard Test Method for Absorption of Architectural Cast Stone.

18 ASTM C 1364 - Standard Specification for Architectural Cast Stone.

19 ASTM D 2244 – Standard Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.

B. Cast Stone Institute (CSI):

01 Cast Stone Institute Technical Manual - Current Edition.

1.4 QUALITY ASSURANCE

A. Cast stone manufacturers must be members of the Cast Stone Institute (CSI) or an

approved equal; and must meet all CSI certification requirements and protocols.

B. Manufacturer Qualifications:
   01 Manufacturer shall have a minimum of ten (10) years of experience in the production of cast stone.
   02 Manufacturer shall have sufficient plant facilities to produce the shapes, quantities and size of cast stone required in accordance with the project schedule.

C. Standards: Comply with the requirements of the Cast Stone Institute® Technical Manual and the project specifications. Where a conflict may occur, the Contract Documents shall prevail.

1.5 WARRANTY

A. Cast stone manufacturer shall provide a written warranty that cast stone shall remain defect free under normal conditions for a period of two (2) years.

B. Defects shall include:
   01 Breaking.
   02 Cracking.
   03 Chipping and / or spalling.

1.6 DELIVERY AND STORAGE

A. Deliver cast stone materials to the site in packaging and protection required to prevent chipping, breaking and / or cracking.

B. Carefully stack cast stone materials on non-staining wood skids clear of the ground.

C. Protect with non-staining plastic membrane or waterproof paper.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Design of cast stone is based on products manufactured by Stone Castle Industries.

B. Acceptable Manufacturers: The following manufacturers are acceptable to furnish the products of this Section, provided all proposed products meet or exceed the specified requirements.
   01 AHI Supply.
   02 Siteworks.

2.2 CAST STONE MATERIAL PERFORMANCE

A. Comply with ASTM C 1364.

B. Physical properties: Provide the following:
   01 Compressive Strength - ASTM C 1194: 6,500 PSI minimum for products at 28 days.
   02 Absorption – ASTM C 1195: 6.0% maximum by the cold-water method.
   03 Air Content – ASTM C 173 or C 231, for wet cast product shall be 4.0-8.0% for units exposed to freeze-thaw environments. Air entrainment is not required for

Vibrant Dry Tamp (VDT) products.

04 Freeze-thaw – ASTM C 1364: The CPWL shall be less than 5.0% after 300 cycles of freezing and thawing.

C. Linear Drying Shrinkage – ASTM C 426: Test and report in accordance with ASTM C1364.

2.3 ARCHITECTURAL CAST STONE RAW MATERIALS

A. Portland cement – Type I or Type III, white and/or grey, ASTM C 150.

B. Coarse aggregates - Granite, quartz or limestone, ASTM C 33, except for gradation, and are optional for the Vibrant Dry Tamp (VDT) casting method.

C. Fine aggregates - Manufactured or natural sands, ASTM C 33, except for gradation.

D. Colors - Inorganic iron oxide pigments, ASTM C 979 except that carbon black pigments shall not be used.

E. Admixtures- Comply with the following:

01 ASTM C 260 for air-entraining admixtures.

02 ASTM C 494/C 495M Types A - G for water reducing, retarding, accelerating and high range admixtures.

03 Other admixtures: Integral water repellents and other chemicals, for which no ASTM Standard exists, shall be previously established as suitable for use in concrete by proven field performance or through laboratory testing.

04 ASTM C 618 mineral admixtures of dark and variable colors shall not be used in surfaces intended to be exposed to view.

05 ASTM C 989 granulated blast furnace slag may be used to improve physical properties. Tests are required to verify these features.

F. Water – Potable

G. Reinforcing bars:

01 ASTM A 615/A 615M: Grade 40 or 60 steel galvanized or epoxy coated when cover is less than 1.5 in.

02 Welded Wire Fabric: ASTM A 185 where applicable for wet cast units.

H. Fiber reinforcement (optional): ASTM C 1116.

I. All fasteners, dowels, retainers and other anchoring devices and shims shall be standard building cast stone anchors commercially available or fabricated for the specific use.

01 All fasteners, anchors, etc. shall be Type 302 or 304 stainless steel.

J. Cast Stone Sealer: Breather type (non-filming forming) siloxane based, clear repellant / sealer.

01 Prosoco Stand Off Limestone and Marble Protector.

02 HydroShield HyroShield Natural Stone Sealant System.

03 Dupont Stonetech Bulletproof Sealer.

2.4 CAST STONE COLOR AND FINISH

A. Color: Match Brick B – DTB Cedar Valley (reference section 04 20 00 – Unit Masonry).

B. All surfaces intended to be exposed to view shall have a fine-grained texture similar to natural stone, with no air voids in excess of 1/32 in. and the density of such voids shall be less than 3 occurrences per any square inch area and not obvious under direct daylight illumination at a distance of 5 feet.

C. Units shall exhibit a texture equal to the sample reviewed and accepted by the Architect when viewed under direct daylight illumination at a distance of 10 feet.

D. ASTM D 2244 permissible variation in color between units of comparable age subjected to similar weathering exposure.
   01 Total color difference – not greater than 6 units.
   02 Total hue difference – not greater than 2 units.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Installing Contractor shall review installation of all substrates and interfacing materials to confirm suitability for the work of this Section.
   01 Notify Contractor and coordinate with other trades as required to address any deficiencies and / or discrepancies.

B. Installing Contractor shall check cast stone materials for fit and finish prior to installation.

C. Do not set unacceptable units.

3.2 SETTING TOLERANCES

A. Comply with Cast Stone Institute® Technical Manual.

B. Set stones 1/8 in. or less, within the plane of adjacent units.

C. Joints, plus - 1/16 in., minus - 1/8 in.

3.3 JOINTING

A. Joint size:
   01 At stone/brick joints 3/8 in.
   02 At stone/stone joints in vertical position 1/4 in. (3/8 in. optional).
   03 Stone/stone joints exposed on top 3/8 in.

B. Joint materials:
   01 Mortar, Type N, ASTM C 270.
   02 Use a full bed of mortar at all bed joints.
   03 Flush vertical joints full with mortar.
   04 Leave all joints with exposed tops or under relieving angles open for sealant.
   05 Leave head joints in copings and projecting components open for sealant.

C. Location of joints:
   01 As shown on shop Drawings or final reviewed Shop Drawings.

D. At control and expansion joints unless otherwise shown.

3.4 SETTING

A. Drench units with clean water prior to setting.

B. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.

C. Set units in full bed of mortar, unless otherwise detailed.

D. Rake mortar joints 3/4 in. in for pointing.

E. Remove excess mortar from unit faces immediately after setting.

F. Tuck point unit joints to a slight concave profile.

3.5 JOINT PROTECTION

A. Comply with requirements of Section 07 92 00 – Joint Sealants.

B. Prime ends of units, insert properly sized backing rod and install required sealant.

3.6 REPAIR AND CLEANING

A. Repair chips with touchup materials furnished by manufacturer.

B. Saturate units to be cleaned prior to applying an approved masonry cleaner.

C. Consult with manufacturer for appropriate cleaners

3.7 WATER REPELLANT

A. Apply breather type (non-film forming) water repellent in accordance with Cast Stone Institute® Technical Bulletin #35 or water-repellent manufacturer's directions.

END OF SECTION

SECTION 05 12 00

STRUCTURAL STEEL FRAMING

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work: The structural framing plans and details indicate general framing required. Other structural steel components and assemblies are indicated on other (non-S) sheets. In addition to work / materials indicated on the structural sheets, Work of this section shall also include, but not be limited to the following:
   01 Loose lintels.
   02 Framed openings in floor and / or roofs for installation of equipment and other “through” work.
   03 Suspension framing for structurally supported masonry lintels.
   04 Flat plate / angle required for masonry supported directly on steel framing.
   05 Sleeves for embedded work.
   06 Other structural shapes / components described in other Division 5 specification sections.

C. Contractor / fabricator shall verify all conditions and requirements for structural steel as required for a complete project as indicated on the Contract Documents.
   01 All required work shall be included in the Base Proposal amount.

D. Related Work:
   01 Section 05 12 13 – Architecturally Exposed Structural Steel Framing.
   02 Section 05 21 00 – Steel Joist Framing.
   03 Section 05 31 00 – Steel Decking.
   04 Section 05 41 00 – Structural Metal Stud Framing.
   05 Section 05 50 00 – Metals Fabrications.
   06 Section 05 51 00 – Metal Stairs.
   07 Section 05 51 33.23 – Alternating Tread Ladders.
   08 Section 05 52 13 – Pipe and Tube Railing.
   09 Section 05 71 13 – Fabricated Metal Spiral Stairs.
   10 Section 05 73 00 – Decorative Handrails.

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer’s literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
   01 Certifications:

a. Material Certifications: Documentation certifying with grade compliance of specified structural steel components.
b. Domestic Source: Documentation certifying source / origin of structural steel components proposed to be furnished.

C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
01 Show profiles, sizes, spacing and location of structural steel members.
02 Details and schedules for fabricating and assembly of structural steel. Include details of cuts, connections, camber, holes, and other pertinent data.
03 Indicate welds by Standard AWS symbols and show size, length and type of each weld.
04 Show profiles, sizes, spacing, and locations of shop fabricated components and assemblies.
05 Show details of shop fabrications, connections and details.
06 Show details of field erection fabrications, connections and details.
07 Provide calculations demonstrating compliance with wind load and other requirements.
08 Shop drawings shall be sealed and signed by a Texas registered engineer.

D. Installation Instructions: Submit manufacturer's complete installation / erection instructions, including fastening, for all products and / or assemblies proposed to be furnished.
01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
02 Generic details that do not depict actual conditions shall not be acceptable.

1.3 REFERENCES

A. American Society for Testing and Materials:
01 ASTM A36 – Structural Steel.
02 ASTM A123 / A123M – Standard Specifications for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.
03 ASTM A153 / A153M - Standard Specifications for Zinc (Hot-Dip) on Iron and Hardware.
04 ASTM A307, Carbon Steel Externally and Internally Threaded Standard fasteners.
05 ASTM A385, Providing High-Quality Zinc Coating (Hot Dip).
06 ASTM A325, High Strength Bolts for Structural Steel.
07 ASTM A500, Cold formed welded and seamless carbon sheet structural tubing in rounds and shapes.
08 ASTM A992, Steel for Structural Shapes for use in Building Framing.

B. Federal Specification: Fed. Spec. TT-P-664 and MIL-P-53030.

C. American Institute for Steel Construction:
01 Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings - Latest Edition.
02 Code of Standard Practice - Latest Edition.

D. American Welding Society: American Welding Society Structural Welding Code D11.1-77.

E. American Iron and Steel Institute Specification for Design Fabricated and Erection of Cold Formed Steel.

1.4 QUALITY ASSURANCE

A. Testing Laboratory Services:
   01 Test results shall meet or exceed established standards.
   02 Testing Lab shall inspect erected steel prior to cover-up to verify conformance with the specified requirements.
   03 Work to be inspected shall include, but not necessarily limited to the following:
      a. Welds at bar joists prior to installation of decking.
      b. Welds / connection of decking to structural components.
      c. Moment connections.
      d. Random torque testing of bolted connections.

B. Building / Construction Components: Meet or exceed established standards.

C. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record the work that is required and its corrections. Structure shall be inspected for compliance with design by District's material and testing lab.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Structural Steel: All structural steel shall be produced domestically in the United States.

B. Non Shrink Grout: Design of non-shrink grout is based on products manufactured by Master Builders Solutions / BASF.

C. Non-Shrink Grout Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this section provided proposed materials meet or exceed all specified requirements:
   01 Sika Chemicals.
   02 Hallemite.
   03 Gifford Hill.

2.2 MATERIALS

A. Structural Steel:
   01 Comply with ASTM A992.
   02 Plates, angles, and channels shall comply to ASTM A36.
   03 Steel Tubes shall comply with ASTM A500 - Grade B (Fy= 46 KSI).

B. Welding: Shall conform to the American Welding Society (AWS) standards and recommendations.

C. Bolts:

01 Comply with ASTM A307, standard bolt and ASTM A325N automatic shearing high strength bolts.
02 Size: 3/4" or as shown on drawings.

D. Shop Painting:
01 Comply with Fed. Spec. TT-P-636.
02 Preparation: Steel shall be clean, dry, and free of rust.
03 Shop-coat all items except galvanized members and members to receive sprayed-on fireproofing. Coordinate as required.

E. Galvanized Metal:
01 Comply with ASTM A123 / ASTM 123M.
02 General: Galvanize all steel sections which are fully or partially exposed to weather, regardless if they are scheduled to receive a finish coat of paint or not.
03 Do not apply silicone protective coating to galvanized steel.

F. Design of Non-Shrink Grout is based on Master Builders Solutions / BASF MasterFlow 885 High-Precision Non-Shrink Grout.
01 Provide below all column base plates; and other locations where indicated on the Drawings.
02 Properties at 28 days:
a. Compressive Strength: 9,000 PSI minimum
b. Volume Change: 0.08% (ASTM C-1107)
c. Flexural Strength: 1,150 PSI
d. Punching Shear Strength: 2,600 PSI

G. Loose Lintels: Unless shown otherwise on the Drawings, provide steel angle lintels bearing 8” each side beyond all masonry openings in the following sizes:
01 0” to less than 5’-0” 3-1/2 x 3-1/2 x 5/16
02 5’-0” to less than 6’-0” 5 x 3-1/2 x 5/16 LLV
03 6’-0” to less than 8’-0” 6 x 3-1/2 x 5/16 LLV
04 8’-0” to 10’-0” 7 x 4 x 3/8 LLV
05 Lintels for openings wider than 10’-0” shall be structurally suspended as indicated on the Drawings.

PART 3 - EXECUTION

3.1 FABRICATION

A. Conform to applicable requirements of "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" issued by the American Institute for Steel Construction.

B. Fabricate structural members in continuous lengths, unless indicated otherwise on the Drawings.

C. All shop fabricated assemblies shall be shop welded.
01 Provide minimum 1/4" continuous fillet welds unless indicated otherwise on the Drawings.
02 Coordinate shop fabricated assembly connections to be made in the field.

D. Size column base plates as required to be concealed in finished Work. Coordinate with other trades as required.

E. Galvanizing:
   01 All structural steel exposed directly to the outside environment shall be galvanized.
   02 Additionally, provide galvanized steel as indicated on the Drawings.
   03 All steel to be galvanized shall be hot-dipped galvanized after fabrication is complete.

F. For fabrication work that will be exposed to view, use only materials that are smooth and free of surface blemishes including rust, roller marks and stamped/rolled trade names.

3.2 ERECTION

A. Conform to applicable requirements of "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" issued by the American Institute for Steel Construction.

B. Provide steel shims or double nut connection at column base plates as required to achieve correct elevations.

C. All beam-to-column, beam-to-beam and similar field connections shall be bolted unless indicated otherwise on the Drawings.

D. Provide temporary bracing and / or tension cables as required to plumb and level structural steel framing.
   01 Leave temporary measures in place until structural steel is loaded (i.e. upper floors poured and cured, all joist bracing is installed, roof deck installed and cured).
   02 Upon removal, verify that all structural steel is plumb and level to elevations indicated on the drawings.

E. Miscellaneous Steel:
   01 Miscellaneous steel includes, but is not limited to joist bracing, suspended lintels and similar assemblies, floor and roof edge angles, and similar non-primary steel components and assemblies.
   02 All miscellaneous steel shall be welded in place unless otherwise indicated on the Drawings.

F. Touch up field connections and other damaged areas in shop coat as erection proceeds. Use same material as shop coat.

G. Grout solid under base plates to required elevations. Allow grout to cure prior to filling column recesses with concrete.

H. All exposed structural steel to be painted. This also applies to structural steel only visible through a window or glass.

I. Confirm red oxide primer is compatible with Division 9 paint for metal. Exposed interior structural steel shall be properly cleaned and painted.

J. Keep steel off of ground with wood blocks.

K. Cranes or other erection machinery shall not be permitted on the foundation slab.

L. For additions and renovations: verify all connection points to existing structure that fireproofing is not ACBM.

END OF SECTION

SECTION 05 21 00

STEEL JOIST FRAMING

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide open web steel joists as indicated on the Drawings.
   02 Provide joist girders as indicated on the Drawings.

C. Related Work:
   01 Section 05 12 00 – Structural Steel Framing
   02 Section 05 31 00 – Steel Decking
   03 Section 05 50 00 – Metal Fabrications
   04 Section 07 81 16 – Cementitious Fireproofing

1.2 SUBMITTALS

A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.
   04 Provide calculations demonstrating compliance with structural loads, wind loads and other requirements.
   05 Shop Drawings shall be sealed and signed by a Texas Registered Engineer.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

1.3 REFERENCES

A. ASTM International:
   01 ASTM A 36/A 36M – Standard Specification for Carbon Structural Steel.
   02 ASTM A 153/A 153M – Standard Specification for Zinc Coating (Hot-Dip) on

Iron and Steel Hardware.
03 ASTM A 307 – Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
04 ASTM A 563 – Standard Specification for Carbon and Alloy Steel Nuts.
05 ASTM B 695 – Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
06 ASTM F 436 – Standard Specification for Hardened Steel Washers.
07 ASTM F 568M – Standard Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners.

B. American Institute of Steel Construction (AISC):
01 AISC 303 - Code of Standard Practice for Steel Buildings and Bridges.

C. Steel Joist Institute (SJI):
01 Steel Joist Institute (SJI) - Standard Specifications, Load Tables & Weight Tables for Steel Joists and Joist Girders.
02 SJI - Code of Standard Practice.

D. American Welding Society (AWS):
01 AWS D1.1 - Structural Welding Code – Steel.

E. Federal Specification: Fed. Spec. TT-P-664 and MIL-P-53030.

F. American Iron & Steel Institute - Design of Cold-formed Steel Structural Members.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Member of the Steel Joist Institute who regularly produces steel joists of the K, LH, or DLH Series, or joist girders conforming to SJI's Specifications and Load Tables and whose designs have been checked and accepted by the Steel Joist Institute.

B. Design connections under direct supervision of Professional Engineer experienced in design of this Work and licensed at Project location.

C. Perform Work in accordance with SJI, Standard Specification, Code of Standard Practice, Load Tables, and Weight Tables, including headers and other supplementary framing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer of steel joists shall be a member of the Steel Joist Institute.

B. The following manufacturers are acceptable to provide products of this Section provided proposed products meet or exceed all specified requirements.
01 New Milennium Building Systems
02 Seyco Joist Company
03 Vulcraft

2.2 MATERIALS

A. Provide Steel Joists in conformance with SJI - Standard Specifications, Load Tables &

Weight Tables for Steel Joists and Joist Girders.

B. Open Web Joists Members, SJI Type, including the following as indicated on the Drawings:
   01 Open Web Steel Joists (K Series).
   02 Longspan Steel Joists (LH Series).
   03 Deep Longspan Steel Joists (DLH Series).
   04 Joist Girders.
   05 Composite Joist (CJ Series).

C. Bridging: Provide bridging of material, size, and type required by SJI Standard Specifications for type of joist, chord size, spacing, and span.

D. Furnish ceiling extensions, where indicated on the Drawings, either extended bottom-chord elements or a separate extension unit to support ceiling construction load indicated on the Drawings. Extend ends to within 1 inch (25 mm) of finished wall surface unless otherwise indicated.

E. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.
   01 Finish: Plain, uncoated at joists contained within the building envelope.
   02 Finish: Hot-dip zinc coating, ASTMA153/A153M, Class C at exterior joists indicated to be galvanized.

F. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
   01 Finish: Plain, uncoated at joists contained within the building envelope.
   02 Finish: Hot-dip zinc coating, ASTMA153/A153M, Class C at exterior joists indicated to be galvanized.

G. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

H. Welding Materials: AWS D1.1; type required for materials being welded.

I. Finish:
   01 Steel joists and joist girders shall be properly cleaned and primed with one coat of manufacturer's standard shop primer in accordance with the SJI Standard Specifications.

2.3 FABRICATION

A. Open Web Steel Joists:
   01 Top Chords and Bottom Chords: Angles or tees.
   02 End Bearing: Double angles or C-sections.
   03 Bearing Point: Flat bearing surface unless shown otherwise on the Drawings.
   04 Provide joist seat extensions as indicated on the Drawings and as required to properly interface with adjacent work.

B. Bridging:
   01 Provide horizontal bridging as indicated on the Drawings and in accordance with Standards of the Steel Joist Institute.
   02 Anchorage: weld bridging to each joist at each contact point with bottom chord and at spandrel members.

03 As recommended by joist manufacturer.

C. Design and fabricate steel joist with camber as required to accommodate the imposed dead loads.

D. Shop Painting:
01 Comply with Fed. Spec. TT-P-636.
02 Preparation of Steel: Clean, dry free of rust, and mill scale.
03 After Erection: Immediately touch up scratched and welds with paint equal to shop coat.
04 Do not shop prime joists to receive direct application of cementitious fireproofing.

PART 3 - EXECUTION

3.1 ERECTION

A. All erection procedures shall comply with Steel Joist Institute's "Code of Standard Practice," unless otherwise indicated or specified.

B. All joist shall be installed parallel and square in configurations as indicated on the Drawings.

C. Coordinate with other trades as required to facilitate angle framed openings through bar joists.

D. Touch up field connections and other damaged areas in shop coat as erection proceeds. Use same material as shop coat.

E. Shop tags shall be removed prior to completion of the project.

F. Coat surfaces to be in contact with mortar, masonry or aluminum using a bituminous coating.

3.2 NOTIFICATION

A. Notify Architect and testing laboratory after all structural steel welds are completed.

END OF SECTION

SECTION 05 31 00

STEEL DECKING

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Steel deck for floor and roof.
   02 Welding and accessories for metal deck.
   03 Cutting openings and reinforcing for openings 18 inches and smaller in any dimension.

C. Related Work:
   01 Section 05 12 00 – Structural Steel Framing.
   02 Section 05 21 00 – Steel Joist Framing.
   03 Section 05 50 00 – Metal Fabrications.

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.
   04 Detailed drawings showing layout of form sheets, anchorage details, supplementary framing, openings, special jointing or other accessories.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

1.3 REFERENCES

A. American Iron and Steel Institute (AISI):

01 North American Specification for the Design of Light Gauge Structural Members.

B. Steel Deck Institute (SDI):
01 Design Manual for Composite Decks, Floor Decks and Roof Decks.
02 SDI Standards.

C. ASTM International:
01 ASTM A36: Standard Specification for Structural Steel.
02 ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
03 ASTM A 780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
04 ASTM A 924/A 924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
05 ASTM A 1008/A 1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

D. American welding Society (AWS):
01 AWS D1.3 - Structural Welding Code – Sheet Metal.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Member in good standing of Steel Deck Institute (SDI).

B. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's North American Specification for the Design of Cold-Formed Steel Structural Members and SDI RDDM Roof Deck Design Manual.

C. Roof Decking:
01 Deck shall meet the minimum design gage and yield strength specified on the drawings or meet minimum specified section properties at specified yield strength.
02 Whenever possible, the deck shall be multi-span.

D. Welding: Qualify procedures and personnel according to AWS D1.3, Structural Welding Code - Sheet Steel.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The following manufacturers are acceptable to provide products of this section:
01 Oates Metal Deck and Building Products.
02 A.C.T. Metal deck Supply.
03 Whitaker Metal Deck Sales.
04 Vulcraft.
05 New Millennium Building Systems.

2.2 MATERIALS

A. Steel Roof Deck - General: Fabricate deck to comply with SDI RD - Standard for Steel Roof Deck, with the minimum section properties indicated. Deck type and thickness shall be as indicated on the Drawings.

B. Design properties shall be computed in strict accordance with "Specifications for the Design of Light Gauge Structural Members", as published by the American Iron and Steel Institute, and Steel Deck Institute Standards.

C. Provide steel deck cut to required lengths where ever practical.

D. Steel deck shall meet the following finish requirements:
   01 All decks shall be galvanized to conform to ASTM A446.
   02 Steel roof deck and supporting members shall be retouched where shop coat has been damaged due to placing, handling or welding.
   03 Provide vented steel deck at all areas to receive insulating concrete fill.

2.3 ACCESSORIES

A. Manufacturer shall supply all ridge and valley plates, cant strips, sump pans and other accessories which must be attached directly to the steel form in order to provide finished surface for application of fill, roofing accessories and roofing.
   01 Coordinate with other trades as required for exact conditions and requirements.

B. Column closures, end closures, side closures and cover plates shall be the standard type provided by the deck manufacturer unless indicated otherwise on the Drawings.

C. Galvanizing Repair Paint for Roof Decks: High-zinc-dust content paint for re-galvanizing welds in galvanized steel conforming to ASTM A 780

D. Fasteners: As manufactured by Hilti, Buildex, Simpson Strong-Tie or approved equal.

E. Flexible Closure Strips.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not install roof deck until supporting construction is in place.

B. Examine support framing and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work of this section.

C. If supporting construction is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Locate deck bundles to prevent overloading of support members.

3.3 INSTALLATION - GENERAL

A. Install deck panels and accessories in accordance with the Contract Documents approved installation drawings and requirements of this Section.

B. Place deck panels on structural supports and adjust to final position with ends aligned. Attach firmly to the supports immediately after placement in order to form a safe working platform.

C. Cut and neatly fit deck units and accessories around openings and other work projecting through or adjacent to the decking.

D. Trades that subsequently cut unscheduled openings through the deck are responsible for reinforcing the openings.

E. Metal deck shall be welded at every corrugated flute and at each bar joist.

3.4 INSTALLATION - ROOF DECK

A. Install and fasten deck and accessories in accordance with the Contract Documents, approved installation drawings and requirements of ANSI/SDI RD.

B. End Bearing: Install deck ends over supports with a minimum end bearing of 1-1/2 inches (38 mm) unless otherwise shown on approved installation drawings.

C. Side Closures: Fasten to supporting structure and deck in accordance with the Contract Documents, approved installation drawings and requirements of ANSI/SDI RD.

D. Ridge and valley plates, flat plates at changes of deck direction and sump pans, shall be fastened to the deck in accordance with the Contract Documents, approved installation drawings and requirements of ANSI/SDI RD.

E. Welds on the metal deck shall be galvanized treated/painted prior to installation of light weight concrete. Welding shall be inspected by the Owner's Roof Consultant, Architect and Third Party testing lab prior to installation of light weight concrete.

3.5 INSPECTION AND REPAIR

A. Before roof insulation placement, the deck shall be inspected for tears, dents, or other damage that may prevent the deck from acting as a tight and substantial form. Replace decking which has been damaged or permanently deflected.

B. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint.

C. Repair Painting: Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.

3.6 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 05 41 00

STRUCTURAL METAL STUD FRAMING

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Light gauge steel framing at exterior walls, and exterior envelope as indicated on the Drawings.
   02 Light gauge structural steel framing at interior locations as indicated on the Drawings.
   03 All comments within this specification section shall be adhered to and included in the design by the Texas registered engineer.

C. Related Work:
   01 Section 05 12 00 – Structural Steel Framing
   02 Section 06 10 00 – Rough Carpentry
   03 Section 09 21 16 – Gypsum Board Assemblies

1.2 SUBMITTALS

A. Provide all submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Product Data: Manufacturer's specifications and other data for all products proposed to be furnished as needed to demonstrate compliance with specified requirements.

C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies based off provided contract documents.
   01 Show profiles, sizes, spacing and locations of framing components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.
   04 Drawings shall depict all conditions of the building envelope.
   05 Include framing and connection details for all envelope wall conditions (i.e. field of walls, rough openings, and special conditions); complete with fastener size, quantity and installation patterns.
   06 If proposed, clearly indicate proposed adjustments to member sizes as indicated on the Drawings; however, such adjustment shall not deviate to a less gauge or less stringent spacing than what is specified.
   07 Provide calculations demonstrating compliance with wind load and other requirements.
   08 Shop drawings shall be sealed and signed by a Texas registered engineer.
   09 All comments within this specification section shall be adhered to and included in the design by the Texas registered engineer.

D. Manufacturer's installation instructions for all components and assemblies based off provided contract documents.

E. Sample Panel: Sample panel shall be 8' long x 6' high panel showing completed exterior light gauge steel framing assembly, complete with exterior sheathing, dampproofing and rigid insulation (where applicable).
   01 Assembly shall include a framed opening.
   02 Coordinate as required with other trades. Refer to Section 04 20 00 – Unit Masonry for additional information.

1.3 QUALITY ASSURANCE AND REFERENCES

A. All materials proposed to be furnished shall comply with the following:
   01 AISI: Specification for the Design of Cold-Formed Steel Structural Members. Latest edition and amendments.
   02 ASTM C955: Standard specification for load bearing (transverse and axial) steel studs, runners (tracks), bracing and bridging for screw application of gypsum board metal plaster bases.
   03 ASTM A653: Steel Sheet, Zinc Coated (galvanized) by the Hot-Dip Process, Structural Quality.
   04 ASTM A924: Steel Sheet, Metallic Coated by the Hot-Dip Process, General Requirements.
   05 ASTM A570: Hot-Rolled Carbon Steel Sheets and Strip, Structural Quality.
   06 ASTM A611: Steel, Cold-Rolled Sheet, Carbon, Structural.
   07 MLSFA: Steel Framing Manual.
   08 Welding Qualifications: Quality welding processes and welding operations in accordance with AWS "Standard Qualification Procedure".

B. The Drawings depict general light gauge steel framing configurations and requirements; and is presumed adequate to permit compliance with the specified performance requirements.

C. Specific design in compliance with this Specification is the responsibility of the light gauge metal framing provider; including, but not limited to:
   01 Member sizes.
   02 Material thicknesses.
   03 Methods and detail of attachment.
   04 Bracing / bridging.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The design of light gauge steel framing is based on products manufactured by ClarkDietrich.

B. The following manufacturers are acceptable to provide products of this Section provided all proposed products meet or exceed specified requirements:
   01 Cemco
   02 Marino/Ware
   03 Mill Steel
   04 The Steel Network
   05 Telling Industries

2.2 MATERIALS

A. Light Gauge Steel Framing:
   01 Steel Studs: Manufacturer’s standard C-shaped steel studs, punched with

stiffened flanges, complying with ASTM C995.

02 Punched web with minimum 1 5/8” flanges with 1/2" inch flange return lip.

03 Steel Track: Manufacturer’s standard U-shaped steel track, unpunched, with unstiffened 1-1/4” flanges, complying with ASTM C955.

04 Steel Deflection / Top Track: Manufacturer’s standard 16 gauge deep-leg U-shaped steel track, unpunched, with unstiffened 2-inch flanges. Flanges may be slotted to accommodate movement in the stud-to-top-track connection.

B. Provide steel framing accessories of the same material and finish used for framing members, Grade 33.

01 Accessories include bracing, bridging, blocking, gusset plates, diagonal strap bracing, kicker and knee braces indicated, or required to provide a complete steel framing system to withstand design loads indicated on the Structural Drawings.

C. Minimum thickness for any / all light gauge steel framing shall be 54 mil, ASTM A653/A653M, Grade A, 33,000 psi minimum yield (FY).

D. Minimum member size for general framing shall be 6”; unless specifically shown otherwise on the Drawings or required per reviewed Shop Drawings.

E. Minimum Material Thicknesses / Mils for Uncoated Steel:

01	16 gauge:	54 Mil
02	14 gauge:	68 Mil
03	12 gauge:	97 Mil

F. Light Gauge Steel Framing Properties: The following table lists minimum criteria for various member sizes and thicknesses:

	Stud Size	Stud Mil	Min Sx
01	2-1/2”	54	0.306
02	2-1/2	68	0.372
03	3-5/8”	54	0.485
04	3-5/8”	68	0.610
05	6”	54	0.953
06	6”	68	1.18
07	8”	54	1.43
08	8”	68	1.77
09	10”	54	1.99
10	10”	68	2.47
11	12”	54	2.62
12	12”	68	3.25

G. Gauge equivalent products shall not be accepted – no exceptions.

H. Light Gauge Steel Framing Properties: The following table lists maximum laterally-unbraced heights for exterior wall framing members spaced 16” O.C. and a maximum deflection of L/360:

	Stud Size	Stud Mil	Max UB Ht.	ClarkDietrich No.
01	6”	54	17’-6”	600S162-54 P
02	6”	68	18’-9”	600S162-68 P
03	8”	54	21’-11”	800S162-54 P
04	8”	68	23’-8”	800S162-68 P
05	10”	54	26’-0”	1000S162-54 P
06	10”	68	28’-2”	1000S162-68 P
07	12”	54	32’-11”	1200S162-54 P

08	12”	68	35’-10”	1200S162-68 P

I. Fastenings:
   01 Stud-To-Track Fasteners: Self-Drilling Self-Tapping Screws, Bolts, Nuts and Washers: Hot-dip galvanized ASTM A653 or Dagger-Guard coated.
   02 Sized and detailed per engineered Shop Drawings.
   03 Track Anchorage Devices: Power-driven or powder-actuated, drilled expansion bolts; or screws with sleeves; sized and detailed per engineered Shop Drawings.
   04 Welding: AWS D1.3; sized and detailed per reviewed Shop Drawings.

J. Miscellaneous Materials:
   01 Provide angle clips, bracing, etc. as required to connect light gauge steel framing to structural steel framing.
   02 Miscellaneous materials shall be the same gauge, or heavier, as the light gauge steel framing is used on.

K. Finish:
   01 Provide minimum G60 galvanized coating per ASTM A653 and ASTM C995.
   02 Touch-up all field welds with inorganic zinc-rich primer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install metal framing systems in accordance with the engineered Shop Drawings and calculations, and manufacturer's installation instructions.

B. Fastening of components shall be by means of approved self-drilling screws or welding.
   01 Screw and welds shall be of sufficient size to ensure strength of connection.
   02 All welding shall comply with American Welding Society "Specification for Welding Sheet Steel in Structure".
   03 All light gauge steel studs shall be fastened to the bottom and top track at both the inboard and outboard track flanges.

C. Runner Tracks: Install continuous tracks to match associated light gauge steel framing members.
   01 Align tracks accurately to layout at base and tops of studs.
   02 Secure tracks as recommended by stud manufacturer, except do not exceed 24 inches O.C. for screw or power-driven fasteners and shall not exceed 16 inches O.C. for other types of attachment.

D. Unless otherwise shown, space studs a maximum of 16 inches O.C.
   01 Space studs less than 16” O.C. in accordance with reviewed Shop Drawings.

E. At a minimum, install continuous, horizontal bridging at mid-height in walls up to 10 feet high, and at 5'-0" O.C. maximum in walls over 10 feet high.
   01 All bridging shall be welded.

F. Coordinate with other trades as required for proper installation of interfacing work.

3.2 TOLERANCES

A. Install exterior wall framing within 1/4 inch plumb over the full height of the wall.

B. Maintain a straight, true wall within 1/4 inch per 40 linear feet length, non-cumulative.

C. Coordinate exact heights required to accept wood blocking, etc. required for the proper installation and interface with work of other trades.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide miscellaneous metal fabricated materials and assemblies as indicated on the Drawings.
   02 Provide metal fabrications as required to complete all structural steel framing.
   03 Coordinate with other trades as required to provide all necessary metal fabrications required to install and interface with their work.

C. Related Work:
   01 Section 05 12 00 – Structural Steel Framing.
   02 Section 05 31 00 – Steel Decking.
   03 Section 05 51 00 – Metal Stairs.
   04 Section 05 52 13 – Pipe and Tube Railing.
   05 Section 07 95 00 – Expansion Joint Covers
   06 Section 08 33 23.13 – Overhead Coiling Perforated Slat Doors
   07 Section 08 33 23.16 – Overhead Insulating Coiling Doors

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.
   04 Provide calculations demonstrating compliance with wind load and other requirements where applicable.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01 Include recommended cleaning products and instructions for use.
   02 Where applicable, provide recommended maintenance schedules and procedures.

1.3 REFERENCES

A. ASTM International:
   01 ASTM A36 - Structural Steel.
   02 ASTM A123 / A123M – Standard Specifications for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.
   03 ASTM A153 / A153M - Standard Specifications for Zinc (Hot-Dip) on Iron and Hardware.
   04 ASTM A307 - Carbon Steel Externally and Internally Threaded Standard fasteners.
   05 ASTM A385 - Providing High-Quality Zinc Coating (Hot Dip).
   06 ASTM A325 - High Strength Bolts for Structural Steel.
   07 ASTM A500 - Cold formed welded and seamless carbon sheet structural tubing in rounds and shapes.
   08 ASTM A992 - Steel for Structural Shapes for use in Building Framing.
   09 ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

B. American Institute of Steel Construction:
   01 Steel Construction Manual, 15th Edition.

C. American Welding Society:
   01 American Welding Society Structural Welding Code D11.1-77.

D. American Iron and Steel Institute:
   01 Specification for Design Fabricated and Erection of Cold Formed Steel.

E. Federal Specification: Fed. Spec. TT-P-664 and MIL-P-53030.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Structural Steel: Comply with ASTM A36.

B. Welding: Comply with American Welding Society Code.

C. Bolts:
   01 Comply with ASTM A307.
   02 Size: 3/4 inch, unless otherwise noted.
   03 Bolts used to fasten roof perimeter blocking to steel framing shall be carriage type bolts.

D. Anchors:
   01 Expansion Bolts:
      a. Rawl Calk-Ins or Arrow Series 4000, 1/4 inch or less.
      b. Rawl Multi-Calks - greater than 1/4 inch. Top shall be 1/2 inch below concrete surface.

02 Molly Screw Anchors:
a. In walls 1/16 - 5/8 inch thick, use "S" length.
b. In walls 5/8 -1 1/4 inch thick, use "L" length.
c. In walls 1 1/4 - 1 3/4 inches thick, use "XL" length.

E. Shop Priming:
01 Shop coat any ungalvanized ferrous metal with primer.
02 Clean iron and metal to be primed of scale, dirt and dust by steel scrapers, wire brushers or sandblasting. Remove oil and grease with petroleum naptha.
03 Thoroughly work paint into all joints by brush. Overall application of brush or spray coat of red lead primer per Fed. Spec. TT-P-86.
04 Give any painted built-in portions one field coat of primer on all abraded parts after installation.

F. Galvanized Metal:
01 Comply with ASTM A123.
02 General: Galvanized all steel sections which are fully or partially exposed to weather, regardless if they are scheduled to receive a finish coat of paint or not.
03 Galvanized items to be painted shall be primed as outlined in Painting and Staining Section.
04 Hot-dip galvanized after fabrication.
05 Silicone protective coating shall not be used at galvanized items scheduled to receive paint.

G. Aluminum:
01 Extruded sections from alloy 6063-T52, meeting the requirements of ASTM B221.
Clear anodized finish samples to be submitted for approval on each item. Submit sample of finish weld.
02 Custom fabricate as shown on the drawings. Grind all welds smooth and flush to match adjoining exposed surfaces. Provide cast wall brackets - Julius Blum #376.
03 All fasteners shall be stainless steel with tamper proof bolts and no pop rivets. Provide flush counter sunk heads.
04 All pipe rails shall be schedule 40 and have welded connections with male/female splice connections, and have a completely smooth flush finish. All corners and angles shall be custom prefabricated. All splices shall occur at supports.
05 Exterior rails shall be all welded construction.
06 Provide clear epoxy coating where aluminum is in direct contact with concrete (only).

2.2 MISCELLANEOUS METAL ITEMS

A. The following is a list of the principal miscellaneous metal items to be furnished under this section. This list is offered only as a guide and Contractor shall thoroughly check Drawings for other miscellaneous metals.
01 All steel items exposed to the exterior shall be hot-dip galvanized after fabrication.

B. Pipe Bollard / Guard Post: Provide and install schedule 40 steel pipe bollard / guard post, in fixed and / or removable configuration as detailed on the drawings.
01 Bollards to be 6 inch in diameter.

02 Provide casting anchors welded to the bollard as indicated on the Drawings
03 Hot dip galvanized after fabrication. Do not paint unless required by Authority having Jurisdiction.
04 At nonremovable bollards, fill with concrete after installation. Provide rounded top.
05 Provide reflective tape at top of bollard.
06 Where bollards are set in concrete, ensure fill is crowned so water does not stand, causing rust to form.
07 Where bollards are installed in locations where gates can swing into them, provide protective cover.
a. Material: HDPE
b. Size: as required to fit bollard
c. Provide domed top
d. Provide reflective tape
e. Color: to be selected by Architect from full range of standard colors.

C. Steel Handrails & Brackets: Furnish and install 1-1/2" O.D. schedule 40 steel pipe rails and handrails in configurations as indicated on the Drawings.
01 Multi component handrail systems shall have welded connections.
02 Design of wall brackets is based on Julius Blum # 306 cast malleable iron 3" handrail bracket; or equal approved by the Architect.
03 Include all other parts required for finished installation.
04 Galvanized steel handrails and brackets to be used at all exterior locations (except at aluminum bleachers). Do not paint.
05 All work shall be in accordance with ADA and Texas Accessibility Standards.

D. Aluminum Handrails & Brackets: Furnish and install 1-1/2" O.D. 6061-T6 or 6063-T53 aluminum pipe rails and handrails in configurations as indicated on the Drawings.
02 Multi component handrail systems shall have welded connections.
03 Design of wall brackets is based on Julius Blum # 316 aluminum 3" handrail bracket; or equal approved by the Architect.
04 Include all other parts required for finished installation.
05 All work shall be in accordance with ADA and Texas Accessibility Standards.
06 Contractor's option to provide stainless steel handrails in lieu of aluminum.

E. Steel Ladders:
01 Provide galvanized steel ladders at all roof hatch locations and where indicated on drawings.
02 Fabricate from steel shapes:
a. Stringers: 9/16" x 2" steel plate.
b. Rungs: minimum 3/4" diameter steel bars; 12" maximum spacing.
c. Anchor stand-off brackets: minimum 2" x 9/16"; locate one (1) at base of ladder and at maximum 10'-0" O.C. above.
03 Weld joints and grind smooth.
04 Secure to structure
05 Ladders to be 30" wide minimum. Coordinate with roof scuttles.
06 Ladders to be hot-dipped galvanized after fabrication. Do not paint.
07 Roof access to extend into roof hatch 6 inches below roof hatch door. Top rung of ladder to be no more than 8" below top of ladder.

08 Coordinate with roof hatch provider / installer as required for proper interface.

F. Loose Lintels - Fabricate from steel shapes as shown; weld joints and grind smooth.
01 Where size is not indicated, provide 4x3x1/4" up to 72" and 5x3x1/4" over 72".
02 Hot dip galvanize after fabrication – do not paint.
03 If field modified, raw ends shall be painted.

G. Masonry Anchors at Steel Columns: Fabricate from 5/16 inch diameter steel, galvanized after fabrication; field weld to columns, space not more than 24 inches O.C. vertically to coincide with horizontal mortar joint elevations. Refer to Structural drawings.

H. Frame Supports: Construct frame supports for all aluminum entrances and storefront / curtain walls as detailed and required for a rigid assembly of the aluminum framing.

I. Miscellaneous Angles: Sizes and shapes as detailed. Use specified galvanized steel for angles at exterior conditions.

J. Below and Above-Ceiling Supports: Construct of Unistrut members or as approved by Architect to size and shape detailed. All work shall be accurate to +/-1/8 inch. Provide supports complete with fastenings to structure for overhead equipment.

K. Ceiling Hung Equipment Supports: Provide supports and trim as indicated on Drawings.

L. Stair Safety Nosings: Balco Type P-300 with abrasive inserts. Color as selected by the Architect from full range of colors.
01 Additional Acceptable Manufacturers:
a. American Safety Tread Co.
b. Safe Metal Co.
c. Wooster Products, Inc.

M. Overhead door supports: Provide 3" x 3" x ¼" steel tubes and base plates at jambs for all overhead doors scheduled for the project, base plate configuration shall allow entire tube and base plate to remain concealed inside wall assembly, anchor base plate to slab as required with expansion anchors of 3/8" min dia. Verify height of tube support required with overhead door manufacturer.

N. Miscellaneous Items: Miscellaneous metal items and their related components are not necessarily individually described. Miscellaneous items not described shall be furnished and installed in accordance with the intent of the drawings and specifications, and as required to complete the work.

O. For all exterior concrete penetrations where steel is in contact with the concrete, ensure fill is crowned so water does not stand, causing rust to form of metal object.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate all trades as required for proper interface of miscellaneous steel and interfacing work.
   01 Concrete foundations at embedded work.
   02 Blocking in walls for wall mounted work.
   03 Steel supports as required.
   04 Coordination with finish flooring.

3.2 INSTALLATION

A. Install products in strict accordance with manufacturer's instructions and final reviewed submittals.

B. Separate all dissimilar metals.

C. Where welding is exposed to view, welds shall be executed neatly then ground smooth. Pits and blemishes are not acceptable.

D. For manufactured items, adhere to printed manufacturer's installation instructions.

E. Refer to Section 09 91 00 – Painting and Re-painting for items that are to receive paint.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide blocking in metal framed drywall partitions and other assemblies as required for the secure attachment of built-in assemblies / products and assemblies / products that anchor to drywall partitions.
   02 Provide treated blocking at all door and window openings in exterior walls as indicated on the Drawings.
   03 Provide treated wood blocking at roofing system as indicated on the Drawings and / or as required to comply with requirements of roofing manufacturer.
   04 Provide plywood backup behind gypsum board at electrical and technology rooms as required for installation of wall mounted equipment.
   05 Coordinate with all trades and material suppliers to ascertain blocking requirements.

C. Related Work:
   01 Section 06 40 00 – Finish Carpentry.
   02 Division 7 – Roofing and Roof Accessories.
   03 Division 8 – Doors, Windows and Glazing.

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer’s literature, product data, MSDS sheets, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Test Reports: Certified test reports showing compliance with the specified performance characteristics and properties.

D. Certificates: Certification from the treatment plant certifying wood treatment applied complies with the criteria and physical requirements for ACQ preservative-treated wood products as specified herein.

E. Shop Drawings
   01 Provide shop drawings indicating all locations and type(s) of blocking proposed to be furnished.

02 Provide shop drawings indicating / describing proposed connection to substrate and adjacent work.

1.3 STANDARDS AND GRADING

A. All lumber used structurally shall be graded and marked with grade and trademark of a lumber grading organization approved by the Architect, except that a certification of grade from such a grading organization may be accepted in lieu of grade and trademarks when approved by the Architect. Trademark of manufacturer shall also appear on each piece.

B. Each piece of plywood used structurally shall carry the American Plywood Association trademark.

C. Grading Rules: Conform with all applicable requirements of American Lumber Standards "Simplified Practice Recommendations R-16" and to grading rules of manufacturer's association under whose rules the lumber is produced.

D. Reference Standards: (Conform with all requirements)
01 U.S. Dept. of Commerce Product Standards.
02 American Wood Preservers Assoc. Standards (as they apply).
03 Architectural Woodwork Institute "Quality Standards".
04 Western Wood Products Association Manual.

E. National Fire Protection Association:
01 NFPA 285 – Standard Fire Test Methods for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Materials

PART 2 - PRODUCTS

2.1 MATERIALS

A. Lumber:
01 Treated No. 2, S4S Southern Yellow Pine:
a. Comply with NWMA Standards.
b. Use for blocking, stripping, grounds, cants and miscellaneous wood items.
02 No. 2, S4S Southern Yellow Pine: Use for framing, blocking, stripping and miscellaneous concealed interior lumber not exposed to concrete, roofing weather or moisture, when FRS lumber is not required by building code.
03 Fire Retardant No, 2, S4S Southern Pine: Lumber shall be pressure-impregnated with non-combustible fire retardant chemicals in accordance with U.L. FRS Fire Hazard Classification. All lumber must be dried following treatment in accordance with AWPA Standard C-20. Use for all blocking in partitions; and other locations where required by building code or indicated on the Drawings.

B. Preservative Wood Treatment:
01 Wood products shall be treated with waterborne, alkali-based wood preservatives listed in Section 4 of AWPA Standards U1, excluding those which contain arsenic and / or chromium.

02 All treated wood products not in direct contact with the ground / earth shall meet requirements standards of the American Wood Preservers Association (AWPA) Standard U1 for Use Category 4A
03 Copper Azole Type-C (CA-C) with minimum treatment rate of 0.15 PCF.
04 Micronized Copper Azole (MCA) with minimum treatment rate of 0.15 PCF.
05 Use galvanized fasteners where not exposed to direct moisture. Use stainless steel fasteners where exposed to direct moisture.

C. Fire Retardant Pressure Treatment of Lumber and Plywood:
01 Lumber: Comply with AWPA U1 UCFA, Type A or ICC-ES ESR 2645.
02 Plywood: Comply with AWPA U1, UCFA, Type A or ICC-ES ESR 2645.
03 Surface Burning Characteristics: UL FR-S rating; or flame spread and smoke developed ratings of 25 or less in a test of 30 minutes' duration in accordance with IBC section 2303.2.
04 Kiln dry after treatment to 19 percent maximum moisture content for lumber and 15 percent for plywood.
05 Treatment: Viance “D-Blaze FRT”; Dricon “Dricon FRT”; or approved equal.
06 Provide fire retardant wood where ever part of a fire rated assembly; where required by code; and where required by local jurisdiction.
07 Provide fire retardant wood in exterior wall assemblies as required to meet NFPA 285 requirements.

D. Plywood:
01 General: Comply with APA Standards.
02 APA A-D, Group 1 Interior used where appearance of only one side is exposed to view for interior locations.
03 Exterior plywood, Group 1, APA rated sheathing. Use where miscellaneous plywood is exposed to concrete or weather.
04 Fire Retardant Treated Plywood - Identical to "C.03" with pressure-impregnated non-combustible fire retardant chemicals in accordance with U.S. FRS Fire Hazard Classification, AWPA Standards C-27. Use when required by building code or noted on drawings.
05 Flooring Underlayment: APA rated Sturdi-floor, exterior grade, tongue and groove edges.

E. Sheetmetal Blocking:
01 Sheetmetal blocking may be an acceptable alternative to wood blocking for wall attached equipment and assemblies.
02 Minimum Size: 16 gauge x 6” height sheetmetal.
03 Pre-galvanized or hot-dipped galvanized material.
04 Sheetmetal blocking shall be continuous, and extend to the next stud beyond the equipment or assembly.

F. Rough Hardware:
01 Nails, Spikes, and Staples:
a. Galvanized for exterior locations, high humidity locations, treated wood not directly exposed to moisture, and fire-retardant treated wood.
b. Type 304 or 316 stainless steel for treated wood directly exposed to moisture.
c. Plain finish for other interior locations.
d. Use largest size and type to suit application.
02 Bolts, Nuts, Washers, Lags, and Screws:

a. Medium carbon steel, A-307 or A-325; size and type to suit application if not noted on the Drawings.
b. Galvanize for exterior locations, high humidity locations, treated wood not directly exposed to moisture, and fire-retardant treated wood.
c. Type 304 or 316 stainless steel for treated wood directly exposed to moisture.
d. Plain finish for other interior locations.
e. Carriage bolts shall be used to connect roof edge wood blocking to the steel perimeter angle.

03 Fasteners: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry and concrete. Bolts or power activated type for anchorage to steel.

G. Treated Wood Isolation: All treated material shall be installed with an isolation sheet between the wood and adjacent metal surface.
01 Provide 15 lb. asphalt impregnated building felt or other isolation material as recommended by the treatment manufacturer.

H. Electrical Room Technology Room / Punch-Down Boards:
01 Use grade stamped DFPA, grade A/D.
02 Provide 4' x 8' sheets of 3/4 inch plywood for telephone boards in mechanical rooms; telephone rooms and other areas where needed for attachment of equipment of other trades.
03 Provide 3/4-inch plywood up to 8’-0” above finish floor and in front of finished gyp board at all walls of the technology Head End Room (alternate names include M.D.F. Room, Building Demarcation Room).
04 Provide one (1), 4’ x 8’ painted, 3/4-inch, fire-treated plywood for telephone punch down blocks and video equipment in IDF Rooms where wall mounted equipment is indicated. Plywood to be held a minimum of 1 inch from floor.
05 In MDF closets, provide a 4’ x 8’ painted, 3/4-inch, fire-treated plywood on all walls from floor to 8’-0” AFF. Plywood to be held a minimum of 1 inch from floor.
06 Where exposed, paint as scheduled in Section 09900.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
01 Blocking in metal framed drywall partitions shall be required at, but not limited to the following locations:
a. All recessed or semi-recessed equipment and assemblies.
b. All wall hung surface equipment and assemblies.
c. All wall attached equipment and assemblies.
d. Other equipment or assemblies as recommended by the manufacturer for proper installation.
02 Any exposed materials in occupied spaces shall have a smooth finish and shall be painted or stained.

B. Wood Blocking:
01 Use standard 2x lumber materials for blocking, nailers and other similar applications. Provide 1x materials where indicated or necessary to achieve the required thickness.

02 Rip, chamfer and / or cut material as required fit the application / assembly.

03 Non-continuous blocking supporting continuous 2x blocking or nailers shall be a minimum of 16” long and installed so the maximum gap is 24”.

04 Blocking at all recessed equipment and fixtures shall be continuous all sides.

05 Bolt nailers and blocking to steel, masonry or concrete members with bolts or proportionate strength of members attached from each end, except as otherwise noted on plans.

06 Blocking Locations: Provide appropriately-treated wood blocking for support of all scheduled work and at all built-in work, in walls for anchoring cabinets, marker boards, classroom technology, restroom accessories, stairway handrails, etc. and at other locations as indicated on the drawings. Metal plate blocking is not allowed.

07 Provide blocking, bucks and framing as necessary and for other trades as required.

C. Roof Edge Wood Blocking:

01 Provide continuous wood blocking at roof perimeter as indicated on the Drawings.

02 Anchor to steel perimeter angle at 24” O.C. maximum using a 3/8” minimum carriage bolt, inserted from the underside of the perimeter angle.

03 Counter-sink wood blocking 3/4" maximum depth to accommodate the bolt washer, nut and any protruding thread.

04 Size length of bolt to not protrude above the top surface of the wood blocking.

D. Plywood:

01 Install plywood over framing in accordance with instruction of American Plywood Association Construction Guide Form No. E30C.

02 Install underlayment plywood in accordance with instructions of American Plywood Association.

03 Space panel joints and edges 1/32 inch.

04 Fill and sand panel edge joints, surface roughness, and damaged or open areas.

05 Fasten with screws spaced at 6 inches at edges and 8 inches in field each way.

E. Sheetmetal Blocking:

01 Contractor shall submit requested locations or conditions proposed to use sheetmetal blocking to the Architect for review and acceptance.

02 Where accepted, sheetmetal blocking shall be fastened / screwed to each metal stud in a minimum of two (2) locations per stud. Use standard drywall screws for fasteners.

END OF SECTION

SECTION 06 20 00

FINISH CARPENTRY

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1- GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Finish Carpentry.
   02 Millwork.
   03 Plastic Laminate.
   04 Installation of finish hardware and plastic laminate doors.

C. Related Work:
   01 Section 06 10 00 – Rough Carpentry
   02 Section 08 14 23.16 – Plastic Laminate Faced Wood Doors
   03 Section 08 71 00 – Door Hardware
   04 Section 12 32 16 – Manufactured Plastic-Laminate-Clad Casework

1.2 SUBMITTALS

D. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.

E. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

F. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   06 Show profiles, sizes, spacing and locations of assembled components.
   07 Show details of shop fabrications, connections and details.
   08 Show details of field fabrications, connections and details.
   09 Provide calculations demonstrating compliance with wind load and other requirements.
   10 Shop Drawings shall be sealed and signed by a Texas Registered Engineer.

G. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   06 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   07 Generic details that do not depict actual conditions shall not be acceptable.

H. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   06 Include recommended cleaning products and instructions for use.
   07 Where applicable, provide recommended maintenance schedules and procedures.

I. Color / Finish Samples:
   06 Provide two (2) samples of each finish for selection by the Architect.
   07 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
   08 Minimum size shall be 3" x 3" but must be large enough to convey attributes of the proposed product.
   09 Submit full range of colors, patterns, and textures for plastic laminate for Architect's selection.
   10 Submit representative, minimum 18" samples of all hardwood proposed to be furnished.
   11 Submit samples of range of stains on actual hardwood samples.
   12 Submit samples of each type of cabinet hardware proposed to be furnished.

1.3 MINIMUM COMPLIANCE STANDARDS

A. The "Quality Standards of the Architectural Woodwork Industry" governs the work, except where more restrictive items are specified.

PART 2 - PRODUCTS

2.1 PLASTIC LAMINATE

A. Thickness: Horizontal grade for all finished / exposed surfaces. Vertical grade may be used for cabinet interiors only. Use .020 balance sheet.

B. Pattern Finish Selection: As selected by Architect.

C. Pattern Range: Include all standard colors

D. Acceptable Manufacturer:
   01 Wilsonart - Ralph Wilson Plastic Co.
   02 Formica - The Formica Corporation.

2.2 SOLID STOCK

A. Moisture Content: Percent of moisture in relation to over-dry weight shall be between 8% and 13% at time of installation.

B. Natural Finish Hardwood: Red Oak. Comply with AWI "Premium" Grade.

C. Paint Grade Hardwood: Any species, including Parana Pine. Do not use Oak, Elm or similar species which have coarse grain.

2.3 HIGH PERFORMANCE CORE MATERIAL

A. All core materials shall be an Industrial Grade particle board which shall meet or exceed performance requirements for ANSI A208.1-1999 M2 Standards.

B. All core materials shall be 3/4" material; minimum 45 lb. density.

C. All core materials shall have a minimum 250 lb. screw holding capacity on the face plane and minimum 225 lb. screw holding capacity on the edge plane.

D. Edging types. 3 mm thick PVC. Solid, high-impact, purified, color-thru, acid resistant, pre-lamination primed edging, machine-applied with hot melt adhesives, automatically trimmed, inside/outside length-radiused for uniform appearance, buffed and corner-radiused for consistent design.

E. Flat Edge PVC: One (1) mm. Solid, high-impact, purified, color-thru, acid resistant PVC edging, machine-applied with hot melt adhesives, automatically trimmed face, back and corners for uniform appearance.

2.4 MISCELLANEOUS

A. Utility shelving: AWI "Economy" grade.

B. Natural Finished Millwork: AWI "Premium" Grade:
   01 Wood Type: White Oak.
   02 Grain Pattern: Rift-cut.

C. Clear Acrylic/Plexiglas: 1/4 inch thick panels fastened to walls where indicated on Drawings.

D. Solid surfacing countertops and window sills shall be quartz with backsplash as indicated on drawings.

2.5 MILLWORK CABINET HARDWARE

A. Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this Section, provide all proposed products meet or exceed the specified requirements.
   01 Knape & Vogt
   02 National
   03 Stanley
   04 Ives

B. Hinges: Heavy duty, five knuckle 2 3/4 inch institutional type hinge shall meet ANSI/BHMA A156.9 Grade 1 requirements. Mill ground, hospital tip. Hinge shall be full wrap around type of tempered steel .095 inch thick. Each hinge shall adjustable in both vertical and lateral directions to assure positive door attachment and alignment.
   01 One pair per door up to 48-inch height. One and one-half pair over 48 inches in height. Hinge shall accommodate 13/16 thick laminated door and allow 270 degree swing.
   02 Finish shall be 26D satin chromium plated finish. Stanley HT1591 Casework Hinge, or approved equal.

C. Pulls: Wire design, solid brass, 4 inches x 1-5/16 inch projection, in 26D satin chromium plated finish. Stanley # 348315-4” or equal.

D. Locks:

01 Cabinet locks, except at clinic, shall be National model C8053 five-pin disc tumbler locks with non-removable core. Keyed, removable cores will not be allowed. Provide grooved key type, nickel-plated cylinder and cam. Locks are to be master keyed to E41A

02 Clinic locks: CCL cam lock Model No. B15760-US26D keyed to AUE39. Stamp AUE39 on cam lock face. All clinic cabinet locksets shall function so that the key to the lock can only be removed when the lock is in the LOCKED position.

03 Cabinet locks in each room shall be keyed alike. All casework in school shall be on one Owner's master key, approved by Owner.

04 Dull chrome finish.

05 Provide Stanley No. 36 catches on non-active leafs on door pairs.

~~06~~ Provide cabinet locks on all units with the exception of casework doors that access plumbing behind the cabinet doors. Stamp all locks with key number on face of cam lock.

~~07~~ Provide one (2) keys <u>per lock</u>, maximum 10 keys per room.

08 Provide sample of cabinet lock for approval by CFISD locksmith and obtain approval before ordering locks.

09 Contractor to provide all casework keys in individually labeled envelopes per classroom. A transmittal showing room number, key number, and quantity of keys shall be included.

10 Provide cabinet locks on all units, unless specifically stated otherwise on drawings.

11 All hardware shall be subject to approval by the Owner/Architect. At existing campuses, all keying shall match existing master key system.

E. Drawer Slides:

01 Standard Drawers: Full extension, telescopic, heavy-duty, self-closing design, steel ball bearing operation with positive in-stop, out-stop. Minimum 100 lb. dynamic load rating life cycle test and 150 lb. static load rating. Electro-zinc plated with lacquer top coat. Knape & Vogt # 8417 or equal.

02 File Drawers: Full extension, 3-part progressive opening slide on precision steel ball bearings; minimum 100 lb. dynamic load rating; hold-in feature to prevent bounce-back; positive in / out stops, Electro-zinc plated with lacquer top coat. Knape & Vogt # 8500 or equal.

03 File Drawers: Provide integral, body mounted molded rails for hanging file system for legal and letter file drawers. Cutting or machining of drawer body / face is not allowed.

04 Hanging file drawer shall accept letter-size hanging files.

F. Catches: Catch shall provide opening resistance in compliance with the Americans with Disabilities Act.

01 Non-Locking Doors: Provide top-mounted magnetic catch for base and wall cabinet doors. Provide two at each tall cabinet door. EPCO no. 592, or equal.

02 Pair of Doors: Furnish a catch equal to EPCO no. 1018, or equal, on the door not receiving a lock. One required on doors up to 48 inches tall and two required (top and bottom) on doors over 48 inches tall.

G. Adjustable Shelf Supports: Twin pin design with anti-tip-up shelf restraints for both 3/4 inch and 1-inch shelves.

01 Design shall include keel to retard shelf slide-off, and slot for ability to mechanically attach shelf to clip.
02 Load rating shall be minimum 300 lbs. each support without failure.
03 Cabinet interior sides shall be flush, without shelf system permanent projection.

H. Sliding Glass Door Hardware:
01 Framed Assembly Sliding Doors: Design based on EPCO Assembly 16 (modified to #730 head / jamb track), complete for the intended installation; or accepted equal.
02 Continuous top and jamb tracks, continuous glazing shoes, track base with double track, and rollers.
03 Sliding Glass Door Lock: Ratchet type lock. Design based on EPCO G05 series locks; or equal. Key to building master.

I. Wardrobe Rod: Shall be 1 1/16 inch rod, supported by flanges both sides, chrome finish or equal. Hanging rod in teacher wardrobe to be mechanically fastened and non-removeable.

J. Coat Hooks:
01 Single prong coat hooks, ceiling mount. Satin finish.
02 Double prong coat hooks, ceiling mount. Satin finish.

K. Grommet:
01 Design is based Doug Mockett & Co. Model “XDP”, 2-1/2” diameter, round grommet with flip top series; or approved equal.
02 Provide one (1) grommet at each non-plumbing knee space with power below countertop.
03 Provide 2-1/2” chrome grommets at cosmetology stations.
04 Color: Black

2.6 PLASTIC LAMINATE BLOCK PANELING

A. Provide plastic laminate finished block paneling in sizes and patterns as indicated on the Drawings.
01 3/4" high pressure core material body.
02 Horizontal grade plastic laminate faces with 0.020 balanced backs.
03 Faces of block paneling shall have no seams or splices.

B. A maximum of three (3) plastic laminates and 3 mil PVC edging shall be selected for application.

C. Block paneling shall be suspended / hung on wall using 1x4 blocking attached to wall and back of panel to provide 3/4" relief off wall. Provide at two locations each panel.

2.7 QUARTZ COUNTERTOPS

A. Provide at locations noted on drawings. Counters shall include backsplashes of same material.

B. Acceptable Manufacturers: Cambria and Silestone

C. Composition: Quartz aggregate, polyester resin and color pigments formed into flat slabs.

D. Colors: As indicated on interior finish legend.

E. Surface Finish: Polished

F. Thickness: 3/4" (2 cm)

G. All quartz countertops shall have 1/2” eased top edge and 1-1/2” radius outside corners.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Positioning: Place approximately level, plumb and at right angles to adjacent work. Maintain consistent spacing between elements where indicated on the Drawings.

B. Fitting: Where field cutting or trimming is necessary, perform in a neat, accurate, professional manner without damaging the products and adjacent work.

C. Anchorage: Attach securely so the products will perform to their maximum ability without damage from inadequate fastenings.

D. Fasten tops to frames with concealed clips, screws and glue.

3.2 PLASTIC LAMINATE DOOR INSTALLATION

A. Carefully verify that doors are properly installed at intended door location and that door prep for finish hardware is accurate and complete.

B. Install all doors plumb and square to frame with +/- 1/8” clearance between door and frame.

C. Install finish hardware in accordance with approved templates.

D. Verify that top and bottom rails are sealed prior to door installation.

E. Take all necessary precautions to protect door finishes before, during and after installation. In the event of damage to the plastic laminate surfacing, replace door.

F. Upon completion of door installation, cycle door several times to confirm that door, frame and hardware are all installed and functioning correctly.

3.3 FINISH HARDWARE INSTALLATION

A. The supplier will mark each item hardware for location. Protect the markings until each item is installed. If any item is delivered to the job not properly marked, return it to the supplier for marking before attempting to install it.

B. Check markings on hardware for proper location. Install and make necessary adjustments for proper working order. Any hardware damaged by improper adjustment or careless abuse will be replaced by the Contractor at his expense.

C. Provide clean, properly sized and accurately placed mortises and drilled holes for all mortise hardware such as locksets and for cylindrical locks where specified only.

D. Accurately fit all surface-applied hardware.

E. After hardware is installed, protect exposed surfaces by use of heavy paper and masking tape and maintain until job completion.

F. Remove all finish hardware except that which is primed for painting before painter's finish is applied. Permanently replace and re-adjust for proper function after painter's finish has dried hard.

G. Do not strip heads of Phillips head screws. Remove and replace all stripped or damaged screws.

H. Refer to Section 08 71 00 – Door Hardware for hardware requirements.

END OF SECTION

SECTION 07 21 00

THERMAL INSULATION

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide all thermal batt / roll insulation at light gauge metal framed exterior walls and building envelope.
   02 Provide acoustical sound attenuation insulation at interior partition cavities where indicated on the Drawings.
   03 Provide rigid foam insulation on all exterior CMU back-up walls.
   04 Provide rigid foam insulation on sheathing of all exterior light gauge metal framed walls.

C. Related Work:
   01 Section 04 20 00 – Unit Masonry.
   02 Section 05 41 00 – Structural Metal Stud Framing.
   03 Division 7 – Roofing.
   04 Section 07 25 00 – Weather Barrier.
   05 Section 09 21 16 – Gypsum Board Assemblies.

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.
   04 Provide calculations demonstrating compliance with wind load and other requirements.
   05 Shop drawings shall be sealed and signed by a Texas registered engineer.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.

02 Generic details that do not depict actual conditions shall not be acceptable.

E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
01 Include recommended cleaning products and instructions for use.
02 Where applicable, provide recommended maintenance schedules and procedures.

F. Sample / Mock-Up Panel: Sample / mock-up panel shall be 8' long x 6' high panel showing selected color range and texture, bonding, mortar color, joint shape, and quality workmanship. Include a brick expansion joint. Sample panel shall remain at the jobsite until all masonry is completed.
01 Panel shall be "L" shaped (4' x 4') with metal stud / drywall back-up wall on one side and CMU back-up on one side. Coordinate as required with other trades.
02 Once accepted by the Architect, the sample panel shall be the standard by which installed is judged.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):
01 ASTM C209 – Standard Test Methods for Cellulosic Fiber Insulating Board.
02 ASTM C272 – water Absorption of Core Materials for Structural Sandwich Constructions.
03 ASTM C518 – Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
04 ASTM C578 – Rigid, Cellular Polystyrene Thermal Insulation.
05 ASTM C665 – Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
06 ASTM D1621 – Compressive Properties of Rigid Cellular Plastics.
07 ASTM D2126 – Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
08 ASTM D1929 – Standard Test Method for Determining Ignition Temperature of Plastics.
09 ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
10 ASTM E96 – Water Vapor Transmission of Materials.

B. Underwriters Laboratory (UL):
01 UL 723 – Surface Burning Characteristics of Building Materials.

C. National Fire Protection Association (NFPA):
01 NFPA 259 – Standard Test Method for Potential Heat of Building Materials.
02 NFPA 285 – Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

PART 2 - PRODUCTS

2.1 MATERIALS – BATT OR ROLL - THERMAL

A. Design of batt or roll thermal insulation is based on products manufactured by Owens-Corning.

B. The following manufacturers are acceptable provided proposed products meet or exceed all specified requirements.
   01 Johns Manville.
   02 Certainteed.
   03 United States Gypsum.
   04 Guardian Building Products.
   05 Knauf Insulation.

C. Design of batt or roll thermal insulation is based on Owens-Corning Eco-Touch Unfaced Insulation.

D. Batt or Roll Thermal Insulation:
   01 Inorganic glass fiber, flexible, unfaced insulation.
   02 R-Values: minimum R+19 at exterior walls at light gauge steel framed walls.
   03 Comply with Type 1 ASTM 665-84 unfaced.
   04 Flame Spread 25 or less.
   05 Provide in widths to match spacing of light gauge steel framing.
   06 Pins and disc securement accessories. Provide a minimum of two (2) pins at the top of each section of insulation to prevent sagging.

2.2 MATERIALS – BATT OR ROLL - ACOUSTICAL

A. Design of batt or roll acoustical insulation is based on products manufactured by Owens-Corning.

B. The following manufacturers are acceptable provided proposed products meet or exceed all specified requirements.
   01 Johns Manville.
   02 Certainteed.
   03 United States Gypsum.
   04 Guardian Building Products.
   05 Knauf Insulation.

C. Design of batt or roll acoustical insulation is based on Owens-Corning Sound Attenuation Batts 150 Insulation.

D. Batt or Roll Acoustical Insulation:
   01 Unfaced inorganic glass fiber or mineral wool insulation specifically designed for noise control.
   02 Thickness: 2” minimum.
   03 Rating in typical 3-5/8” stud wall with 1 layer 5/8” gyp board each side: 47 STC minimum; 0.95 NRC.
   04 Flame Spread: 25 or less.
   05 Pins and disc securement accessories. Provide a minimum of two (2) pins at the top of each section of insulation.

2.3 MATERIALS – CONTINUOUS RIGID INSULATION

A. Design of continuous rigid insulation is based on products manufactured by Atlas Roofing.

B. The following manufacturers are acceptable provided proposed products meet or exceed all specified requirements.
   01 Dow Chemical Co.
   02 Johns Manville.
   03 Owens-Corning.
   04 Pactiv / Green Guard.
   05 Rmax.

C. Design of continuous rigid insulation is based on Atlas Roofing Energy Shield Pro Rigid Insulation.

D. Rigid Board Insulation:
   01 Closed cell, polyisocyanurate (polyiso) foam core faced with a reflective 12 mil reinforced foil facers on one side and a white 12 mil reinforced acrylic-coated aluminum facer on the other.
   02 Classified Type X in accordance with ASTM C578.
   03 Certified to comply with NFPA 285 in assemblies shown.
   04 Minimum thickness:
      a. 1 ½" at CMU back-up.
      b. 1-1/2" thick at light gauge steel framed back-up walls.
   05 Aged thermal resistance: R-5.0 per inch minimum.
   06 Flame Spread: Class A flame spread, <25 ASTM E84.
   07 Smoke Development: <450 ASTM E84.
   08 Water vapor transmission: 0.1 perm maximum.
   09 Water Absorption: < 1% by volume ASTM C209.
   10 Compressive strength: 20 PSI minimum.
   11 Size at light gauge steel framed back-up walls: 4' x 8' sheet size. Minimize joints as much as practical.
   12 CMU back-up walls: Width to fit between vertical spacing of masonry reinforcement.

E. Rigid Board Insulation Adhesive:
   01 Provide manufacturer's recommended adhesive for substrate being applied.
   02 Verify compatibility with weather barrier materials.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Batt or Roll Thermal Insulation:
   01 Batts shall fit between studs and provide full coverage at exterior building envelope.
   02 Install in continuous lengths where ever possible.
   03 Install adhesive-mounted spike devices with metal caps at 2'-0" vertically, and 4 inches horizontally from each side of the blanket.
   04 Install blankets with long dimensions running vertically on spikes, keeping blankets tight to exterior wall without crushing.
   05 On the exterior side of all structural steel located directly behind sheathing.

B. Batt or Roll Acoustical Insulation:
   01 Place acoustical insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions and tight to items passing through partitions.

02 Install in continuous lengths where ever possible.
03 Install adhesive-mounted spike devices with metal caps at top of each blanket, and 4 inches horizontally from each side.
04 Suspend blankets 1” above finish floor.

C. Rigid Board Insulation:
01 Install board insulation at exterior masonry walls between masonry reinforcement in accordance with manufacturer’s printed instructions. Do not bend or alter masonry ties to secure rigid insulation in place.
02 Install board insulation on dampproofed sheathing at all light gauge steel framed walls.
03 Secure insulation boards to back up surface with manufacturer’s recommended adhesive that is compatible with weather barrier product.
04 Install with joints tight to provide full coverage.
05 Cope / cut insulation to fit irregularities, masonry ties and obstructions as required to achieve full coverage.
06 Take precautions to assure that insulation board is concealed within cavity wall construction.

3.2 PROTECTION

A. Upon completion of batt insulation, use all means necessary to protect material from becoming wet.
01 In the event batt or acoustical insulation comes in direct contact with moisture or becomes wet, remove and discard, and replace insulation with dry material.
02 In the event batt insulation becomes damp or moist, thoroughly dry insulation prior to covering up.
03 Use all means necessary to assure that batt and acoustical insulation is completely dry at the time of cover-up and will not promote the growth of mold.

B. Protect rigid insulation as required to prevent damage and delamination.

END OF SECTION

SECTION 07 25 00

WEATHER BARRIER

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope: Provide a complete integrated system of components specifically designed to provide a complete fluid-applied membrane air barrier at the building envelope walls. System shall include:
   01 Fluid-applied membrane air barrier suitable for application on masonry and gypsum board substrates.
   02 Joint reinforcement, tape, compound and treatment.
   03 Elastomeric flashing.
   04 Sealant.
   05 Adhesives and Primers.
   06 Other components as required for a complete installation as recommended by the manufacturer.

C. Related Work:
   01 Section 04 20 00 – Unit Masonry.
   02 Section 05 41 00 – Structural Metal Stud Framing.
   03 Section 06 10 00 – Rough Carpentry.
   04 Section 07 21 00 – Thermal Insulation.
   05 Section 07 65 26 – Self-Adhering Sheet Flashing.
   06 Section 09 21 16 – Gypsum Board Assemblies.

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit shop drawings showing:
   01 Locations and extent of vapor permeable air barrier assemblies.
   02 Details of all typical conditions, intersections with other envelope assemblies and materials, membrane counter-flashings, and details showing how gaps in the construction will be bridged.
   03 How inside and outside corners are negotiated, how materials that cover the vapor permeable air barrier are secured with air-tight condition maintained.
   04 How miscellaneous penetrations such as conduits, pipes, electric boxes and similar items are sealed.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

E. Submit documentation from an approved independent testing laboratory certifying the air leakage rates of the air barrier membranes assembly, including primary membrane, primer and sealants have been tested to meet ASTM E2357.

F. Submit documentation from an approved independent testing laboratory certifying the air leakage and vapor permeance rates of the air barrier membranes, including primary membrane and transition sheets, exceed the specified requirements and in accordance with ASTM E2178.
   01 Test report submittals shall include test results on porous substrate and include sustained positive and negative wind load and gust load air leakage results.

G. Manufacturer Certifications signed by manufacturer:
   01 Certifying their review of the project shop drawings and that the air barrier system complies with specified requirements.
   02 Certification of compatibility with specified rigid insulation (07 20 00) and self-adhering sheet flashing (07 65 26).

H. Manufacturer's Field Service:
   01 Provide site reports from authorized field service representative, indicating observation of fluid-applied membrane air barrier system installation.
   02 Reports shall be required on a weekly basis (minimum) throughout the installation phase(s).
   03 Following completion of Work, submit manufacturer's report of final inspection and acceptance of completed installation.

I. Sample / Mock-Up Panel: Sample / mock-up panel shall be 8' long x 6' high panel showing selected color range and texture, bonding, mortar color, joint shape, and quality workmanship. Include a brick expansion joint. Sample panel shall remain at the jobsite until all masonry is completed.
   01 Panel shall be "L" shaped (4' x 4') with metal stud / drywall back-up wall on one side and CMU back-up on one side. Coordinate as required with other trades.
   02 Once accepted by the Architect, the sample panel shall be the standard by which installed is judged.

J. Operations and Maintenance Manuals:
   01 Provide complete operations and maintenance manuals to the Owner.
   02 Refer to section 01 78 23 – Operations and Maintenance Manuals.
   03 O & M manuals must be reviewed, accepted and delivered to the Owner prior to Owner demonstration(s).

K. For warranties longer than one (1) year, submit a sample of the warranty proposed to be furnished.

1.3 REFERENCES

A. American Architectural Manufacturers Association (AAMA):
   01 AMMA 2400-02, Standard Practice for Installation of Windows with a Mounting Flange in Stud Frame Construction.

B. American Society for Testing and Materials (ASTM):
   01 ASTM D412, Standard Test Method for Vulcanized Rubber and Thermoplastic Elastomers – Tension.
   02 ASTM D471, Standard Test Method for Rubber Property - Effect of Liquids.
   03 ASTM D1970, Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
   04 ASTM D2243, Standard Test Method for Freeze-Thaw Resistance of Water-Borne Coatings.
   05 ASTM D5590, Standard Test Method for Determining the Resistance of Paint Films and Related Coatings to Fungal Defacement by Accelerated Four-Week Agar Plate Assay.
   06 ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
   07 ASTM E96, Standard Test Methods for Water Vapor Transmission of Materials.
   08 ASTM E283, Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
   09 ASTM E330, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
   10 ASTM E331, Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
   11 ASTM E1354, Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter.
   12 ASTM E1677, Standard Specification for Air Barrier (AB) Material or System for Low-Rise Framed Building Walls.
   13 ASTM E2112, Standard Practice for Installation of Exterior Windows, Doors and Skylights.
   14 ASTM E2178, Standard Test Method for Air Permeance of Building Materials.
   15 ASTM E2357, Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.

C. National Fire and Protection Agency (NFPA):
   01 NFPA 285, Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

1.4 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Manufacturer shall demonstrate a minimum of ten (10) years of experience in fluid-applied membrane air barriers.

B. Applicator Qualifications:

01 The applicator of the fluid-applied membrane air barrier material specified herein shall be a manufacturer's licensed / authorized applicator.
02 Applicator shall have a minimum of five (5) years of experience in the application of fluid-applied membrane air barrier.

C. Source Requirements: Obtain primary materials from a single manufacturer regularly engaged in manufacturing vapor permeable air barrier materials. Obtain secondary materials from a source acceptable to the primary materials manufacturer.

1.5 WARRANTY

A. Warranty:
01 Manufacturer's standard warranty for fluid-applied membrane weather barrier for a period of ten (10) years.
02 Warranty Areas: Warranty shall cover all vertical surfaces receiving the fluid-applied membrane weather barrier materials – field surfaces, joints flashings.
03 Coordinate with manufacturer for on-site observations and requirements for issuance of warranty.

B. Installation Warranty: Provide air barrier subcontractor's 2 year warranty, including all components of the weather barrier assembly, against failures including loss of air tight seal, loss of watertight seal, loss of adhesion, loss of cohesion, failure to cure properly.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Design of Fluid Applied Weather Barrier is based on products manufactured by Henry Company.

B. The following manufacturers are acceptable for use for this Section, provided all specified requirements are met or exceeded.
01 Prosoco.
02 W.R. Meadows.
03 Dupont.
04 Tremco.
05 Poly-Guard.

2.2 PRODUCTS

A. Design of Fluid Applied Weather Barrier is based on the following Henry Company products:
01 Henry Air-Bloc 17MR Fluid Applied, Vapor Permeable Air & Water Barrier Membrane.
02 Henry HE925 BES Sealant and Joint Treatment.
03 Henry Adhesives and Primers.
04 Henry Air-Bloc 21 Insulation Adhesive (refer to section 07 20 00 – Building Insulation).
05 Henry Blueskin SA Flashing (refer to section 07 65 26 – Self-Adhering Sheet Flashing).

06 Henry Blueskin TWF Thru-wall Flashing (refer to section 07 65 26 – Self-Adhering Sheet Flashing).

B. Henry Air-Bloc 17MR Fluid Applied, Vapor Permeable Air & Water Barrier Membrane. One-component, water-based, elastomeric emulsion membrane, designed to provide a vapor permeable air and water barrier when applied above-grade wall assemblies, having the following properties:

01 Solids Content:
   a. By Weight: 63%.
   b. By Volume: 53%.
02 Service Temperature:
   a. Low Temperature: -40 degrees F (-40 degrees C).
   b. High Temperature: +180 degrees F (+80 degrees C).
03 Application Temperature:
   a. Low Temperature: +20 degrees F (-6 degrees C).
   b. High Temperature: +122 degrees F (+50 degrees C).
04 Tensile Strength (ASTM D412): 104 psi (717 kPa).
05 Elongation (ASTM D412): 420%.
06 Low Temperature Flexibility @ -22 degrees F (-30 degrees C) (ASTM D1970): Pass.
07 Freeze-Thaw Resistance (ASTM D2243): Pass; 10 cycles.
08 Nail Sealability (ASTM D1970): Pass.
09 VOC Content: 100 grams/liter max.
10 Water Absorption (ASTM D471, modified): 5.6%.
11 Water Vapor Permeance (ASTM E96 B) @ 40 mils nominal dry film: 14 perms.
12 Air Permeability:
   a. Assembly Air Leakage (ASTM E2357): Pass.
   b. Building Material (ASTM E2178): 0.0001 cfm/ft2 (0.0005 L/s.m2).
13 Chemical Resistance: Resists salt solutions, mild acids and alkalis. Non-resistant to oils, grease or solvents.
14 Fire Testing (NFPA 285): Complies in various assemblies.
15 Flame Spread/Smoke Development (ASTM E84): 10/15.
16 Resistance to Mold, Mildew, and Fungal Growth (ASTM D5590): No growth.

C. Design of building envelope and sheathing joint sealant is based on Henry HE925 BES Sealant: Moisture cure, medium modulus polymer modified sealing compound, having the following properties:

01 Complies with Fed. Spec. TT-S-00230C, Type II, Class A.
02 Complies with ASTM C920, Type S, Grade NS, Class 35.
03 Elongation: 450 – 550%.
04 Remains flexible with aging.

D. Design of rigid insulation adhesive is based on Henry Air-Bloc 21 Insulation Adhesive: Synthetic trowel applied rubber based adhesive having the following characteristics:

01 Compatibility: With air barrier membrane, substrate and insulation.
02 Air leakage: 0.0026 CFM/ft^2 @ 1.6 lbs/ft^2 to ASTM E283.
03 Water vapor permeance: 0.03 perms to ASTM E96.
04 Long term flexibility: CGSB 71-GP-24M.

E. Other materials and accessories as recommended by the manufacturer to provide an integrated, compatible weather barrier system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Substrate Conditions:
   01 Verify substrates to receive work and surrounding adjacent surfaces are in accordance with Air Barrier Manufacturer published literature prior to installation of fluid applied membrane air barrier assembly.
   02 Sheathing panels must be securely fastened and installed flush to ensure a continuous substrate in accordance with Air Barrier Manufacturer published literature.
   03 Fastener penetrations must be set flush with sheathing and fastened into solid backing.
   04 Mortar joints in concrete block and form tie holes/voids in poured concrete shall be filled, flush, smooth, and allowed to be cured for a minimum of twenty-four (24) hours.
   05 Cap and protect exposed back-up walls against wet weather conditions prior to application of fluid applied membrane air barrier assembly.

B. Notify contractor in writing of any conditions that are not acceptable.

C. The installing contractor shall examine and determine that surfaces and conditions are ready to accept the Work of this section in accordance with published literature. Commencement of Work or any parts thereof shall mean installer acceptance of the substrate.

3.2 PREPARATION

A. All surfaces must be sound, dry to touch, clean, and free of oil, grease, dirt, excess mortar, frost, laitance, loose and flaking particles, or other contaminants.

B. Protect adjacent surfaces not included in scope of Work to prevent spillage and overspray.

C. Hot weather or direct-sun applications over porous substrates, such as concrete, promote rapid surface drying and can form blisters in the fluid applied membrane air barrier during curing. To aid in blister prevention prepare substrate in accordance with one of the following optional procedures:
   01 Prime coat:
      a. Apply a thin prime coat of fluid applied membrane air barrier to substrate.
      b. Allow fluid applied membrane air barrier to fully cure prior to subsequent application.
      c. Install primary fluid applied membrane air barrier to Air Barrier Manufacturer minimum recommended mil thickness.
   02 Two coat:
      a. Apply fluid applied membrane air barrier to achieve one-half (1/2) of Air Barrier Manufacturer minimum recommended mil thickness.
      b. Allow fluid applied membrane air barrier to fully cure prior to subsequent application.
      c. Apply fluid applied membrane air barrier to achieve one-half (1/2) of Air Barrier Manufacturer minimum recommended mil thickness.

d. Overall dry mil thickness shall be in accordance with Air Barrier Air Barrier Manufacturer published literature.

3.3 INSTALLATION

A. Ensure substrate is ready to receive fluid applied membrane air barrier in accordance with published literature.

B. If fluid applied membrane air barrier should freeze while in storage, move containers to a controlled environment above 32 degrees F (0 degrees C) until thawed and re-mix using a hand operated power mixer prior to use.

C. Fluid applied membrane air barrier shall not be applied when ambient (air) and substrate temperatures are below 20 degrees F (-6 degrees C).

D. Do not proceed with application of air barrier membrane when rain is expected within 16 hours.

E. Apply sealant at sharp corners, changes in substrate plane, penetrations, and edges to form a smooth transition from one plane to another.

F. Non-Moving Substrate Joint and Crack Treatment:
   01 Gaps at sheathing joints or openings through sheathing - equal to or less than 3/8 inch (10 mm) wide:
   02 Sheathing Joint Sealant:
      a. Apply sealant at rate recommended by Air Barrier Manufacturer.
      b. Spread sealant at joint extending a minimum one (1) inch beyond gap to ensure a continuous air and watertight assembly.
   03 For all gaps in excess of 3/8”, seal in strict accordance with manufacturer’s standards and recommendations for the specific condition.

G. Refer to Air Barrier Manufacturer detail drawings for installation procedures including, but not limited to, the following:
   01 Inside corners.
   02 Outside corners.
   03 Crack treatment.
   04 Penetrations.
   05 Rough openings.
   06 Control joints.
   07 Expansion joints.
   08 Changes in substrate.

H. Contact Air Barrier Manufacturer to coordinate transition of fluid applied membrane air barrier to adjacent areas including, but not limited to, the following:
   01 Roof to air barrier.
   02 Air barrier to waterproofing.
   03 Fastener penetrations.

I. Thru-Wall Flashing: Coordinate with Section 07 62 23 – Thru-Wall Flashing and section 07 65 26 – Self-Adhering Sheet Flashing.

J. Primary Liquid Air Barrier Membrane:

01 Install fluid applied membrane air barrier in accordance with Air Barrier Manufacturer published literature to ensure an air and watertight fluid applied membrane air barrier assembly.

02 Fluid applied membrane air barrier assembly must be installed in a monolithic application without breaks, sags, runs, pinholes or voids, and transitioning with auxiliary components to create a uniform drainage plane and air barrier.

03 Install fluid applied membrane air barrier and transition membranes so that subsequent membrane installation laps one (1) inch (2.5 cm) onto existing membrane ensuring an air and watertight fluid applied membrane air barrier assembly.

04 Fluid applied membrane air barrier total dry thickness shall be in accordance with Air Barrier Manufacturer published literature. Refer to Air Barrier Manufacturer Technical Data Sheet.

K. Insulation Adhesive: Coordinate with other trades as required.

01 Coordinate with Section 07 20 00 – Building Insulation for insulating materials.

02 Upon curing of the air barrier membrane system apply insulation adhesive in a serpentine pattern.

03 Immediately embed insulation into the adhesive and press firmly into place to ensure full contact. Apply additional adhesive if allowed to skin over.

04 Fully butter all joints of insulation panels with adhesive during installation, with the exception of expansion joints.

3.4 FIELD QUALITY CONTROL

A. Final Observation and Verification:

01 Prior to covering completed weather barrier work, final inspection of fluid applied membrane air barrier assembly shall be carried out by the Architect, the Contractor, and Air Barrier Manufacturer as required by warranty.

02 Contact Air Barrier Manufacturer for warranty issuance requirements.

B. Fluid applied membrane air barrier assembly is not designed for permanent UV exposure. Refer to Air Barrier Manufacturer published literature for product limitations.

3.5 CLEANING

A. Promptly as the Work proceeds, and upon completion, clean up and remove from the premises all rubbish and surplus materials resulting from the foregoing Work.

B. Clean soiled surfaces, spatters, and damage caused by Work of this Section.

C. Check area to ensure cleanliness and remove debris, equipment, and excess material from the site.

END OF SECTION

SECTION 07 41 13

METAL ROOF PANELS

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 The work includes furnishing labor, materials and installation of pre-finished metal panel roofing, trim, flashing, and miscellaneous parts as indicated on Drawings and described herein.
   02 The work also includes roof deck system below metal roofing consisting of rigid plywood decking and waterproofing underlayment.

C. Related Work:
   01 Section 05 31 00 – Steel Decking
   02 Section 06 10 00 – Rough Carpentry
   03 Section 07 21 00 – Thermal Insulation
   04 Section 07 42 13 – Metal Wall Panels
   05 Section 07 62 00 – Sheet Metal Flashing
   06 Section 07 72 00 – Roof Accessories
   07 Section 10 73 26 – Aluminum Walkway Coverings
   08 Section 13 34 19 – Metal Building Systems

1.2 SUBMITTALS

A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: To be prepared by metal roof system manufacturer shall include layouts of panels, details of edge conditions, joints, corners, custom profiles, supports, anchorages, trim, flashing, closures and special details. Distinguish between factory and field assembly work.
   01 Provide metal roof flashing, gutter and downspout shop drawings. Indicate gauge and finish of material, fastener type, finish and spacing, locations of field applied sealant, and location size and gauge of all back up plates.
   02 Roof Panel Attachment:
      a. Roof plan with wind uplift pressure calculations at field, corner and perimeter areas according to version of ASCE-7 referenced by locally adopted Building Code and the authority having jurisdiction.
      b. Roof plan indication roof clip spacing pattern at field, corner, perimeters and where panels are to be fixed from thermal movement.

c. Roof panel attachment plan must be stamped by licensed engineer in State in which project is constructed, certifying roof attachment meets local Building Code requirements for wind uplift.

D. Engineering Calculations:
01 Submit wind uplift pressure calculations according to ASCE 7 Wind Speed for project location with respect to appropriate Importance Factor, Exposure category and Safety Factor. Calculations shall be sealed by a professional Engineer licensed to practice structural engineering in the state in which project is located.

E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
01 Include recommended cleaning products and instructions for use.
02 Where applicable, provide recommended maintenance schedules and procedures.

F. Samples:
01 Color charts or samples from the manufacturers standard line of Kynar 500 finishes for Architect's selection.
01 Sample of 12" long, full width coated panel showing metal gauge, seam and required color and finish.
02 Two samples of roof panel clip, clip fastener, bearing plate, and spacer block.

G. Submit sample warranties:
01 Coating Warranty.
02 Manufacturer Water Tightness Warranty complying with this Specification.
03 Installer Warranty.

H. Certification:
01 Submit roof panel manufacturer's certification that fasteners, clips, backup plates, closures, roof panels and finishes meet specification requirements, wind uplift requirements.
02 Submit roof panel manufacturer's certification that installer meets requirements to install roof system and is qualified to obtain required warranties.
03 Uplift Test Reports –Certified test results that indicate roof system meets or exceeds design and performance criteria. Testing to include:
a. Underwriters Laboratory: Submit documentation that panel System has been tested at Underwriters Laboratories per UL-580 and be currently listed under a UL Construction Number. Submit documentation that panel system has been tested in accordance with UL-580/1897 and has been tested to failure.
b. ASTM E 1592. Submit ASTM E 1592 Test reports prepared by independent test laboratory and stamped by a professional engineer substantiating that roof system will meet the allowable wind pressures with a safety factor of 2.0.
04 Static Water Testing Certification:
a. The panel system shall be tested in accordance with FM4471 Appendix G and pass with no leakage. The test specimen must

successfully withstand being submerged under 6” of water for a minimum period of 7 days.

b. The panel system shall be tested in accordance with ASTM E2140- and pass with no leakage. The test specimen must successfully withstand being submerged under 6” of water for a minimum period of 6 hours.

05 Air and Water Testing Certification:

a. ASTM E1680 – Manufacturer’s test data for air infiltration rates up to 20 pounds per square inch differential pressure.

b. ASTME1646- Manufacturer’s test data for water infiltration rates up to 20 pounds per square inch differential pressure.

06 Impact Resistance: Submit documentation that panel system has been tested at Factory Mutual per FM 4471 Section 4.5 and is currently rated for “Severe Hail”.

I. Operations and Maintenance Manuals:

01 Provide complete operations and maintenance manuals to the Owner.

02 O & M manuals must be reviewed, accepted and delivered to the Owner prior to Owner demonstration(s).

1.3 REFERENCES

A. ASTM International:

01 ASTM A 653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

02 ASTM A 755 - Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.

03 ASTM A 792/A 792M - Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

04 ASTM D 1003 - Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics.

05 ASTM D 2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.

06 ASTM D 4214 - Test Methods for Evaluating Degree of Chalking of Exterior Paint Films.

07 ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings.

08 ASTM E283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

09 ASTM E 1514 - Standard Specification for Structural Standing Seam Steel Roof Panel Systems.

10 ASTM E 1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.

11 ASTM E 1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.

12 ASTM E 1680 - Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems.

13 ASTM E 1980 - Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

B. Factory Mutual: 4471 Approval Standard for Class 1 Panel Roofs:

01 Section 4.1 Combustibility-From Below Roof Assembly.

02 Section 4.2 Combustibility-From Above Roof Assembly.

03 Section 4.3 Wind Uplift Resistance.
04 Section 4.4 Foot Traffic Resistance.
05 Section 4.5 Hail Damage Resistance.
06 Appendix G- Susceptibility to Leakage Test Procedure for Class 1 Panel Roofs.

C. SMACNA: Architectural Sheet Metal Manual, Latest Edition.

D. American Society of Civil Engineers (ASCE):
01 ASCE -7 - Minimum Design Loads for Buildings and Other Structures, version adopted by local Building Code authority having jurisdiction.

E. Building Code – as approved by local authority having jurisdiction.

1.4 DESIGN AND PERFORMANCE CRITERIA

A. Thermal Movement: Metal Roofing system, including flashing, shall accommodate unlimited thermal movement without buckling or excess stress on the structure.

B. Roof panel and trim attachments will be designed to satisfy the requirements of the roof design as shown in Shop Drawings.

C. Maximum wind uplift capacity of roof system shall be determined using certified results from UL 1897-98, Uplift Tests for Roof Covering Systems. Testing of the entire roof assembly shall be conducted in a UL-580 test chamber.

D. Panel system installation shall be in accordance with ASCE 7 Wind Speeds for project location with respect to appropriate Exposure category, Building Importance Factor and a Safety Factor of 2.0.

E. Framing, panels, components, trim and accessories, including installation requirements shall be provided in strict accordance with TDI requirements.

F. Wind Load Requirements:
01 Exposure: B.
02 Risk Category: III
03 Wind Speed: 140 MPH, 3 second gusts.

G. Design Code: Structural design shall be provided by the metal roof panel manufacturer for the following design criteria:
01 International Building Code (IBC) 2018.

1.5 QUALITY ASSURANCE

A. Manufacturer: Manufacturer’s facility and equipment must undergo an annual quality assurance audit by Factory Mutual. This assures that manufacturer’s equipment, procedures and quality program are maintained to ensure a uniform product consistent with that which was tested and FM Approved.

B. Installer of pre-formed metal roofing shall be experienced in the work and shall have no fewer than five (5) years of successful experience with installation metal roof systems similar to those required for this Project, and is qualified by the roof panel manufacturer, for installation of manufacturer-warranted systems.

C. Field Measurements: Prior to fabrication of panels, take field measurements of structure or substrates to receive panel system. Allow for trimming panel units, where final dimensions cannot be established prior to fabrication.

D. Install a 30-foot wide, quality control area of metal roofing, for review by the Architect, to establish the quality of installation for the roof, and have approved prior to installing additional metal panels.

1.6 COORDINATION

A. Coordinate Work, with installation of other associated Work, to ensure quality application.

B. Coordinate Work with installation of associated metal flashings and building walls.

C. Coordinate Work to minimize foot traffic and construction activity on installed finished surfaces.

D. Coordinate location of pipe penetrations to allow centering of pipe in panel.

E. Coordinate location of roof curbs, to allow proper integration with roof panel seams.

1.7 WARRANTY

A. Panel Coating: Furnish manufacturer's twenty (20) year panel coating warranty covering against becoming unserviceable or causing an objectionable appearance resulting from either defective or non- conforming materials and workmanship. Defects shall include but not be limited to the following:
   01 Leaking, checking, crazing, chalking, fading, and adhesion.
   02 Cracking, chipping or peeling of finish.
   03 Wrinkling, undue expansion, lifting, loosening, and splitting seams.

B. Provide manufacturer's twenty (20) year durability warranty against rupture, structural failure and perforation due to corrosion, and against chalking, cracking and peeling.

C. Provide manufacturer's twenty (20) year No Dollar Limit warranty for weather-tightness. Weather-tightness warranty shall include labor and materials and shall apply to the roof system specified including related flashings, valleys, ridges, roof panels, roof penetrations, roof curbs, and trim.

   01 Warranties supplied by Metal Roof Installer or 3rd Party Warranties are not acceptable.

PART 2 – PRODUCTS

2.1 METAL ROOF PANELS

A. The design of metal roof panels is based on products manufactured by Schulte Building Systems (SBS).

B. Other acceptable manufacturers: The following manufacturers are acceptable to provide metal roofing panels, provided the proposed products meet or exceed all specified requirements.

01 Alliance Steel Buildings
02 American Steel Building
03 Atas International
04 Athens Steel Buildings
05 Butler Manufacturing Company
06 Centria
07 Englert, Inc.
08 Imetco
09 Kirby Building Systems
10 MBCI
11 Metallic Building Company
12 McElroy Metal
13 Mid-West Building Company
14 Morin; a Kingspan Group Company
15 Nucor Building Systems
16 PAC-CLAD
17 Red Dot Building Systems
18 USA Steel
19 Varco Pruden
20 Whirlwind Steel Building Company

C. Basis of Design: Schulte Building Systems VS-216 Standing Seam Metal Roof Panel.
01 Tested in accordance with ASTM E 1646 and E 1680 for water penetration and air infiltration, and per ASTM E1592 for wind uplift capacity.
02 Panels to be installed on a flat substrate shall be factory formed.

D. Panel Substrate: Galvalume coated sheet steel, Type AZ-50, Grade 50 as described in ASTM A792; minimum 24 gauge.

E. General: A mechanically seamed pan-type standing seam roof panel with concealed clips.

01 Panels shall be field seamed to meet wind upload requirements, equal to Schulte Building Systems VS-216 Standing Seam Metal Roof Panel.
02 Panels must be furnished and installed in continuous lengths from ridge to eave with no endlaps.
a. Panels too long to ship will be manufactured on site using manufacturer's employees and equipment.
03 Panels to be installed on a curved substrate shall be field formed in continuous lengths.

F. Physical Characteristics:
01 Gauge: Minimum 24; provide 22 gauge where required to meet wind load requirements.
02 Width: 12"
03 Seam Height: 2"

04 Texture: Smooth

G. Panel Clips:
01 Clips: Floating type.
02 Clips used to attach panel to substrate shall provide minimum 3/8" air space between panel and roof deck to reduce heat transfer into the building envelope.
03 Provide manufacturer's standard profiles, gauge(s) and spacing as required to meet wind load requirements.

H. Characteristics:
01 All panels shall be symmetrical in design and shall be mechanically seamed with a field operated electric seaming machine provided by the manufacturer.
02 Seam cap matching panel finish with two rows of integral factory hot applied sealant.
03 Manufacturer watertightness warranty, meeting requirements of this Section.

I. Finish:
01 1.0 mil. Fluropolymer (PVDF) Two Coat system: 0.2 mil primer with 0.8 mil Kynar 500 (70%) MICA color coat.
02 Finish to be selected from manufacturer's standard color selection.
a. SR:0.48, E:0.84, SRI:0.54
03 The back side of the material should be .25 mil primer and 0.25 polyester wash coat. Color shall be selected by the Architect.

J. Fasteners and Accessories:
01 Concealed supports, angles, plates, accessories and brackets: in gauge and finish as recommended, and furnished by manufacturer.
02 Accessory Screw: Size and screw type as provided by panel manufacturer for each use, with prefinished hex washer head in color to match panels where exposed to view.
03 Rivets: full stainless steel, including mandrel, in size to match application.
04 Field Sealant: Color coordinated primerless silicone, or high grade, non-drying butyl, as supplied by panel manufacturer.
05 Sealant Tape: non-drying, 100 percent solids, high grade butyl tape, as supplied by panel manufacturer, in sizes to match application.
06 Pipe Penetration Flashings: flexible boot type, with stainless steel compression ring, and stainless steel pipe strap, Dektite by Buildex, or approved substitute. Use silicone type at hot pipes.
07 Metal Roof Curbs: welded aluminum, or stainless steel, factory-insulated, with integral cricket, and designed to fit roof panel module, sized to meet application, by L.M. Curbs, or approved substitute.

2.2 RIGID DECKING

A. Nailable Sheathing Deck:
01 Provide and install nailable plywood sheathing above rigid insulation board.
02 Nailable Plywood Sheathing: type CDX plywood, minimum 5/8" thickness.
03 Provide in 4' x 8' sheets.

04 Provide screw fasteners of sufficient length to penetrate metal deck substrate a minimum of 1”.

2.3 ROOFING UNDERLAYMENT

A. The design of roofing underlayment is based on products manufactured by W.R. Grace & Co.

B. Other acceptable manufacturers: The following manufacturers are acceptable to provide roofing underlayment, provided the proposed products meet or exceed all specified requirements.
01 Atlas International
02 Carlisle
03 GAF
04 Henry Company
05 Soprema

C. Design of underlayment is based on Grace Ice & Water Shield HT.

D. General:
01 Self-adhering roofing underlayment comprised of an aggressive rubberized asphalt adhesive backed by a layer of slip resistant coated high density cross laminated polyethylene film.
02 Backed with release paper.
03 Membrane Thickness: Minimum 40 mils – ASTM D3767 method A.
04 Membrane Tensile Strength: 250 PSI – ASTM D412.
05 Membrane Elongation: 250% - ASTM D412.
06 Membrane Permeance: 0.05 Perms – ASTM E96.
07 Membrane Roll Width: 36”. Use maximum roll width wherever possible to eliminate joints.

PART 3 - EXECUTION

3.1 PREPARATION PRODUCT HANDLING, STORAGE AND DELIVERY

A. Immediately upon delivery to job site, place materials in area protected from weather. Materials shall be sorted and handled to prevent inclusion of foreign materials and damage by water or weather.
01 Exercise care in unloading, storing and erecting panels to prevent bending, warping, twisting and surface damage.
02 Storage: Store in original packages that are designed to protect against transportation damage, until ready for use. Store all material and accessories above ground on well skidded platforms. Store under waterproof covering. Provide proper ventilation to panels to prevent condensation build-up between each panel.
03 Remove from site panels which are damaged, or become water-stained during storage and handling. Remove, and replace materials, which are installed damaged, or stained.
04 Do not permit unnecessary walking on finished roof. All personnel installing finished roof shall be required to wear rubber sole shoes.

B. Ensure surfaces are ready for panel application.

C. Inspect and ensure surfaces are free from objectionable warp, wave, and buckle before proceeding with installation of pre-formed metal roofing.

D. Ensure substrate is ready to receive metal roofing. Report items for correction and do not proceed with metal roof panel system installation until resolved.

3.2 INSTALLATION OF RIGID INSULATION AND PLYWOOD DECK

A. Rigid Insulation:
   01 Install rigid insulation directly on metal decking.
   02 Insulation shall be installed in full size sheets wherever possible.
   03 When rigid insulation deck is made up of multiple layers, stagger joints at half-points in both directions.
   04 Install panels with tight joints.

B. Plywood Decking:
   01 Install plywood decking directly on rigid insulation.
   02 Plywood shall be installed in full size sheets wherever possible.
   03 Stagger joints with rigid insulation at half-points in both directions.
   04 Install panels with tight joints.

3.3 INSTALLATION OF UNDERLAYMENT

A. Install underlayment directly on a clean, dry solid substrate of plywood sheathing.

B. Install in maximum widths and lengths to minimize joints.

C. Work from low to high so that all laps shed water.

D. Side Laps: Minimum 3.5”. End Laps: Minimum 4”.

3.4 INSTALLATION OF STANDING SEAM ROOFING OVER PLYWOOD

A. Comply with and install roofing and flashings in accordance with all details shown on manufacturer’s approved Shop Drawings and manufacturer's product data and instructions, within specified erection tolerances.

B. Install field panels in continuous lengths, without endlaps. Remove and replace panels with endlaps.

C. Do not install panels damaged by shipment or handling.

D. Install intermittent clips with bearing plates and continuous clips according to pattern in wind uplift rating at field, corners and perimeter roof areas.

E. Fix panels at location depicted on reviewed Shop Drawings.

F. Breadpan roof panel at ridge, hip and headwalls.

G. Allow for 1-inch panel clearance at penetrations.

H. Install concealed supports, angles and brackets as furnished by manufacturer to form complete assemblies.

I. Remove roof panel and flashing protective film prior to extended exposure to sunlight, heat, and other weather elements.

J. Field-apply sealant tape and gun-grade sealant according to reviewed shop drawings and manufacturer's requirements for airtight, waterproof installation.

K. Ensure sealant beads and tape are applied prior to sheet metal installation to achieve a concealed bead. Neatly trim exposed portions of sealant without damaging roof panel or flashing finish.

L. Align pipe penetrations to occur at center of roof panel. Report and have corrected improperly placed penetrations before proceeding with panel installation. Remove and replace roof panels which have improperly placed penetration flashings.

M. Align roof curbs to fit roof panel module and overlap standing seam(s). Allow for proper drainage on both sides of curb.

N. Install sheet metal flashings according to manufacturer's recommendations, reviewed shop drawings and in accordance with provision of **Section 07 62 00 – Sheet Metal Flashing**.

3.5 WORKMANSHIP

A. Install panel systems straight and true, free from defects. Isolate dissimilar metal contact with proper taping and/or coatings. Install flashing and corners to provide a watertight system.

3.6 CLEANING

A. Clean exposed surfaces of Work promptly after completion of installation.

B. Clean mud, dirt, and construction-related debris from panels before panels are scratched or marred.

3.7 PROTECTION

A. Protect Work as required to ensure roofing will be without damage at time of final completion.

B. Do not allow excessive foot traffic over finished surfaces.

C. Do not track mud, dirt, or construction-related debris onto panel surfaces.

D. Replace damaged Work before final completion.

3.8 INSPECTION

A. Architect and Contractor reserve the right to inspect the work during application.

B. Upon completion of the Work, if inspection discloses that roofing is not according to specifications or has been damaged, Contractor agrees to furnish additional materials necessary to make repairs and place work in an acceptable condition.

END OF SECTION

SECTION 07 42 13

METAL WALL PANELS

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 – GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 All exterior metal wall panels, soffits and associated flashing, sub-girts, sealants, and fasteners necessary to complete metal building system and as indicated on the Drawings.

C. Related Work:
   01 Section 01 11 23 – Code Summary
   02 Section 05 12 00 – Structural Steel Framing
   03 Section 07 21 00 – Thermal Insulation
   04 Section 07 41 13 – Metal Roof Panels
   05 Section 07 62 00 – Sheet Metal Flashing
   06 Section 07 92 00 – Joint Sealants
   07 Section 08 11 13 – Hollow Metal Doors and Frames
   08 Section 08 33 23.13 – Overhead Insulated Coiling Doors
   09 Section 08 71 00 – Door Hardware
   10 Section 08 90 00 – Louvers and Vents
   11 Section 10 73 26 – Aluminum Walkway Coverings
   12 Section 13 34 19 – Metal Building Systems

1.2 SUBMITTALS

A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.

02 Generic details that do not depict actual conditions shall not be acceptable.

E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
01 Include recommended cleaning products and instructions for use.
02 Where applicable, provide recommended maintenance schedules and procedures.

F. Color / Finish Samples:
01 Provide two (2) samples of each finish for selection by the Architect.
02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
03 Minimum size shall be 3" x 3", but must be large enough to convey attributes of the proposed product.

1.3 REFERENCES

A. ASTM International:
01 ASTM A653/A653M Standard Specification for Steel Sheets, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
02 ASTM A792/A792M Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy Coated by the Hot-Dip Process.
03 ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
04 ASTM D2247 Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
05 ASTM E1680 Standard Test Method for Determining the Rate of Air Leakage Through Exterior Metal Roof Systems Under Specified Pressure Differences Across the Specimen.
06 ASTM E1646 Standard Test Method for Water Penetration of Metal Roof Systems by Uniform Static Air Pressure Difference.
07 ASTM G90 Standard Practice for Performing Accelerated Outdoor Weathering of Non-Metallic Materials Using Concentrated Natural Sunlight.

B. Sheet Metal and Air Conditioning Contractors National Association (SMACNA) Architectural Sheet Metal Manual.

1.4 DESIGN - GENERAL

A. Framing, panels, soffits, components, trim and accessories, including installation requirements shall be provided in strict accordance with code requirements.

B. Wind Load Requirements:
01 Exposure: B.
02 Risk Category: III
03 Wind Speed: 140 MPH, 3 second gusts.

1.5 DESIGN REQUIREMENTS

A. Design Code: Structural design shall be provided by the metal wall panel manufacturer for the following design criteria:
   01 International Building Code (IBC) 2018
   02 Storage Building Occupancy Category: Low Hazard Storage, Group S-2.

1.6 QUALITY ASSURANCE

A. Manufacturers Qualifications: The manufacturer shall have had a minimum of ten (10) years of experience in the successful completion of projects employing similar materials, applications, and performance requirements.

B. Sheet Metal Industry Standard: Comply with Sheet Metal and Air Conditioning Contractors National Association (SMACNA) Architectural Sheet Metal Manual.

1.7 DELIVERY, STORAGE & HANDLING

A. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact. Identify fabricated components with UL 90 label where appropriate.

B. Packing, Shipping, Handling and Unloading:
   01 Bundle panels in waterproof wrapping paper when nested, or wooden crates when panels cannot be nested.
   02 Package trim and accessories in waterproof wrapping paper.

C. Storage and Protection: Store materials protected from exposure to harmful conditions. Store material in dry, above-ground location.
   01 Stack prefinished material to prevent twisting, bending, abrasion, scratching and denting. Elevate one end of each skid to allow for moisture run off.
   02 Store products of this section in manufacturer's unopened packaging until installation of products.
   03 Maintain dry, heated storage area for products of this section until installation of products.

1.8 WARRANTY

A. Paint Finish Warranty: The manufacturer shall warrant against fading, chalking, peeling, cracking, checking, chipping, or erosion to base metal of the exterior panel finish for twenty (20) years and in accordance with the paint supplier's standards.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Design of metal wall panels is based on Products manufactured by Schulte Building Systems (SBS).

B. Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this Section, provide all proposed products meet or exceed the specified requirements.
   01 Alliance Steel Buildings
   02 American Steel Building
   03 AEP Span
   04 Berridge
   05 Butler Manufacturing Company
   06 Kirby Building Systems
   07 Metallic Building Company
   08 MBCI
   09 McElroy Metal Inc.
   10 Mid-West Building Company
   11 Nucor Building Systems.
   12 Pac-Clad
   13 Red Dot Building Systems
   14 USA Steel
   15 Varco Pruden
   16 Whirlwind Steel Building Company

2.2 SYSTEM DESCRIPTION

A. Panel Performance Requirements: Provide panels, which have been manufactured, fabricated and installed to withstand structural and thermal movement, wind loading and weather exposure to maintain manufacturer's performance criteria without defects, damage, failure or infiltration of water.

B. Air Infiltration: Maximum 0.011 CFM/LF of seam at static pressure of +/-6.24 PSF when tested per ASTM E1680.

C. Water Penetration: No uncontrolled water penetration through the panel joints at a static pressure of 12.0 PSF when tested in accordance with ASTM E1646.

D. Finish Performance Requirements:
   01 Color Change and Fade Resistance: No cracking, peeling, blistering or loss of adhesion when tested in accordance with ASTM G23; color change, after removal of surface deposits such as dirt or chalk, maximum 5 Hunter units.
   02 Humidity Resistance: No blistering, peeling or loss of adhesion, after 2000 hours testing in accordance with ASTM D2247.

2.3 WALL PANELS

A. Design of metal wall panels is based on Schulte Building Systems PBR Wall Panel.

B. Schulte Building Systems PBR Wall / Soffit Panel: A through-fastened sidewall panel with 1 ¼" ribs at 12" on center. The area between the ribs is reinforced to minimize oil-canning.
   01 Gauge: 26
   02 Dimensions: 38 1/2" wide by 1 1/4" high.
   03 Provide in continuous lengths from sill to eave.

C. Soffit Panels: A flush-type panel profile with one pencil rib, 12 inches wide x 1" deep.

01 Gauge: 22 minimum
02 Texture: Smooth
03 Panels shall have identical interlocking side joints and shall have a factory-applied sealant. Concealed fastening system.

D. Liner Panels: Schulte Building Systems PBR Wall Panel: A through-fastened sidewall panel with 1 1/4 inch (32mm) ribs at 12 inches (305mm) on center. The area between the ribs is reinforced to minimize oil-canning.
01 Gauge: 26.
02 Dimensions: 38 1/2 inches (915mm) wide by 1 1/4 inch (32mm) high.

E. Material: Galvalume Sheet Steel conforming to ASTM A792; AZ55 coating for bare; AZ50 coating for painted.
01 Thickness: Minimum 26-gauge sheet thickness.

F. Panel Fasteners:
01 All self-tapping sheet metal screws shall conform to A.S.A. Standard B 18.6 and shall have Type "A" or Type "AB" threads.
02 Screws shall be equipped with metal and EPDM or neoprene washers.
03 Optional self-drilling fasteners shall be No. 12-14 Type B self-drilling screw with non-walking point and two step thread to insure maximum strip-out torque in panel to panel usage.
04 Screws and washers shall be carbon steel plated with .0003" thick zinc or cadmium.
05 After plating, all exposed fasteners and washers shall be coated with one prime coat and two finish coats of baked silicone polyester. The color of the finish shall match the wall and/or roof panels.
06 Spacing and locations of fasteners shall meet requirements for wind loading.

2.4 TRIM AND ACCESSORIES

A. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fascias, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Metal flashing and trim components shall be manufacturer’s standard products and profiles as recommended by the manufacturer for the specific application.

C. Material: Galvalume Sheet Steel conforming to ASTM A792; AZ55 coating for bare; AZ50 coating for painted.
01 Thickness: Minimum 26-gauge sheet thickness.

D. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance.
01 Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fascias, parapet caps, soffits, reveals, and fillers.

E. Gutters and Downspouts:
01 Provide continuous gutters where indicated on the Drawings.
02 Fabricate profiles of gutters to overflow nominally 1” below bottom edge of roof panel.
03 Provide downspouts where indicated on the Drawings.
04 Fabricate downspouts with offsets as required to interface with the profile of the building at overhangs.

05 Provide 1” nominal straps at downspouts at maximum 6’-0” O.C., with the bottom strap within 12” of the base of the downspout.
06 Refer to Section 07 62 00 – Sheet Metal Flashing.

F. Fasteners: Self-tapping screws and other acceptable corrosion-resistant fasteners recommended by roof manufacturer designed to withstand design loads.
01 Where exposed fasteners cannot be avoided, supply fasteners with EPDM or neoprene gaskets, with heads matching color of metal panels by means of plastic factory-applied coatings.
02 Spacing and locations of fasteners shall meet requirements for wind loading.

G. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

H. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

I. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
01 Concealed Joint Sealants: Non-curing butyl, AAMA 809.2.
02 Exposed Joint Sealants: Urethane, single component, ASTM C920.
03 Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.5 MATERIAL FINISH

A. Finish: Finish for all exposed sheetmetal work shall be a premium, factory applied / baked on PVDF paint finish using a Kynar 500 resin base, containing a minimum of 70% floropolymer, meeting AAMA 2605-98 standards.
01 BASF “Fluoroceram”.
02 PPG Industries “Duranar”.
03 The Velspar Corporation “Fluopon”.
04 Color on finish side shall be as selected by the Architect from the manufacturer’s standard colors.
05 Provide a strippable, protective coating material on all finished portions of pre-finished flashing; to be removed following installation.

B. Finish for all wall and trim components shall be as selected by the Architect from manufacturer’s full range of standard color selections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
   01 Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
   02 Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
   03 Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages in accordance with ASTM C754 and metal panel manufacturer's written recommendations.

3.3 METAL PANEL INSTALLATION

A. General: Install metal panels in accordance with manufacturer's written instructions in orientation, sizes, and locations indicated. Spacing and locations of fasteners shall meet requirements for wind loading.

B. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   01 Shim or otherwise plumb substrates receiving metal panels.
   02 Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
   03 Install screw fasteners in predrilled holes.
   04 Locate and space fastenings in uniform vertical and horizontal alignment.
   05 Install flashing and trim as metal panel work proceeds.
   06 Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
   07 Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
   08 Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
   01 Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
   02 Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
   03 Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
   04 Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
   05 Flash and seal panels with weather closures at perimeter of all openings. Where possible, panels shall be lapped against prevailing wind.

E. Retain "Watertight Installation" Paragraph below for hydrostatic (watertight) panel installation; delete for water-shedding panel installations.

F. Watertight Installation:
   01 Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
   02 Provide sealant or tape between panels and protruding equipment, vents, and accessories.
   03 At panel splices, nest panels with minimum 4” end lap, sealed with sealant and fastened together by interlocking clamping plates.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual".
   01 Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
   02 Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems.
   03 Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.

3.4 DAMAGED MATERIAL AND CLEANING

A. Damage caused by the manufacturer or Wall Panel Systems Contractor shall be repaired or replaced.

B. The General Contractor shall inspect and approve each completed wall area and be responsible for protecting finished work from damage by other trades.

C. The Wall Panel Systems Contractor shall remove all protective materials and labels from the wall components as they are installed.

D. The General Contractor shall be responsible for final cleaning of the wall panel system due to any conditions that occur after the Wall Panel Systems Contractor has completed an area. Cleaning is to be done in accordance with the manufacturer's instructions.

END OF SECTION

SECTION 07 52 00

MODIFIED BITUMINOUS MEMBRANE ROOFING

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Refer to Section AB – Instructions to Proposers and Section AF – Subcontractor / Manufacturer Prequalification for substitutions.

B. Scope of Work:
   01 Provide all labor, equipment, and materials to install the modified bitumen roof system over light weight insulating concrete over metal deck substrate.
   02 Provide walkway pads, sheetmetal flashings, expansion joints, and other work incidental to the complete and proper installation of a watertight modified bitumen membrane roofing system whether shown or not on the drawings or as specified herein, and in accordance with all applicable manufacturer's requirements of the roofing system for issuance of the specified warranty.

C. Related Work:
   01 Section 03 52 16 – Lightweight Insulating Concrete
   02 Section 06 10 00 – Rough Carpentry
   03 Section 07 62 16 – Sheet Metal Flashing
   04 Section 07 72 00 - Roof Accessories.
   05 Division 22 – Plumbing
   06 Division 23 – HVAC
   07 Division 26 - Electrical

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.
   01 Failure to follow required provisions may result in submittal being rejected without review.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
   01 Product data shall include test certificates / reports, other certifications and applicable documentation to demonstrate compliance and as required by the specification.

C. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface with adjacent assemblies / materials depicted in the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

03 Where blocking is required, clearly indicate type, size and location; and coordinate with other trades as required for proper installation

D. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
01 Include recommended cleaning products and instructions for use.
02 Where applicable, provide recommended maintenance schedules and procedures.

E. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
01 Show profiles, sizes, spacing and locations of assembly components.
02 Show details of shop fabrications, connections and details.
03 Show details of field fabrications, connections and details.
04 Provide calculations demonstrating compliance with wind load and other design / code requirements.
05 Shop drawings shall be sealed and signed by a Texas registered engineer.

F. Certifications:
01 Provide letter from manufacturer, signed by an officer, stating the installer is licensed and / or certified by the manufacturer to provide the installation.
02 Certification of Class A roof system.
03 Submit certification that the roof system furnished is Tested and Approved by Factory Mutual Standard No. 4470 as a Class 1 roof assembly with 1-90 Wind Uplift Requirements.
04 Certified copy of ISO 9002 compliance.

G. Design Loads: Submit copy of manufacturer's minimum design load calculations according to ASCE 7-05, Method 2 for Components and Cladding, sealed by a registered professional engineer employed by the system manufacturer as a full-time staff engineer.
01 In no case shall the design loads be taken to be less than those required by applicable codes and authorities having jurisdiction.

H. Operations and Maintenance Manuals
01 Provide complete operations and maintenance manuals to the Owner.
02 Refer to section 01 78 23 – Operations and Maintenance Manuals
03 O & M manuals must be reviewed, accepted and delivered to the Owner prior to Owner demonstration(s).

I. Warranty:
01 Provide one (1) sample of each warranty proposed to be furnished.

1.3 REFERENCES

A. American Society of Testing and Materials (ASTM):
01 ASTM C920 - Standard Specifications for Elastomeric Joint Sealants.
02 ASTM D41 - Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
03 ASTM D312 - Specification for Asphalt Used in Roofing
04 ASTM D451 - Test Method for Sieve Analysis of Granular Mineral Surfacing for Asphalt Roofing Products

05 ASTM D1079 - Terminology Relating to Roofing, Waterproofing, and Bituminous Materials
06 ASTM D1227 - Specification for Emulsified Asphalt Used as a Protective Coating for Roofing
07 ASTM D1863 - Specification for Mineral Aggregate Used on Built-Up Roofs
08 ASTM D2178 - Specification for Asphalt Glass Felt Used in Roofing and Waterproofing
09 ASTM D2822 - Specification for Asphalt Roof Cement
10 ASTM D2824 - Specification for Aluminum-Pigmented Asphalt Roof Coating
11 ASTM D3019 - Specification for Lap Cement Used with Asphalt Roll Roofing
12 ASTM D4479 - Standard Specification for Asphalt Roof Coatings—Asbestos-Free
13 ASTM D4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free
14 ASTM D4601 - Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing
15 ASTM D4897 - Standard Specification for Asphalt-Coated Glass-Fiber Venting Base Sheet Used in Roofing
16 ASTM D5147 - Test Method for Sampling and Testing Modified Bituminous Sheet Materials
17 ASTM D5849 - Standard Test Method for Evaluating Resistance of Modified Bituminous Roofing Membrane to Cyclic Fatigue (Joint Displacement)`
18 ASTM E108 - Test Methods for Fire Test of Roof Coverings

B. FM: Factory Mutual

C. NRCA: National Roofing Contractors Association: Roofing and Waterproofing Manual

D. Underwriters' Laboratories (UL): Fire Hazard Classifications.

E. Sheet Metal and Air Conditioning Contractors National Association Inc. (SMACNA): Architectural Sheet Metal Manual.

1.4 MANUFACTURER / INSTALLER QUALIFICATIONS

A. Manufacturer Qualifications: Roofing system manufacturer shall have a minimum of 10 years' experience in manufacturing modified bitumen roofing products in the United States and shall be ISO 9002 certified.

B. Installer Qualifications:
01 Shall be specializing in modified bituminous roof application with minimum 5 years' experience.
02 Shall be certified by the roofing system manufacturer as qualified to install manufacturer's roofing system.
03 Shall be among manufacturer's top-tier installers.

C. No subcontracting of sheet metal fabrication or installation will be accepted. Contractor must have a sheet metal shop on the company premises.

D. It is the intent of this specification to provide a roof system with an external fire rating.
   01 The descriptions given below are general descriptions.
   02 All components shall be as required by the membrane manufacturer to provide a Class One F.M. No. 4470 assembly.

E. Installer's Field Supervision:
   01 Installer to provide a full-time Supervisor / Forman on the job site during all phases of modified bituminous sheet roofing work.
   02 Direct supervision of workmen shall be maintained at all times when roofing work is in progress.
   03 The project specifications and final submittals shall be accessible on the roof and used by the Supervisor / Foremen at all times when roofing work is in progress.

F. The Contractor's shall closely monitor roofing work cause deficiencies to be immediately corrected during construction.

G. The Contractor shall coordinate all trades as required for proper installation of work interfacing with roofing work.

H. Pre-construction Roofing Conference: Prior to installation of metal roofing deck, conduct a meeting at the site with roofing installer, installer of each component of associated work, installers of deck or substrate construction to receive roofing work, installers of rooftop units and other work in the around roofing that must precede or follow roofing work (including MEP work), Architect, roofing system manufacturer's representative, District's Project Manager, District's material testing lab, and other representatives directly concerned with performance of the Work, including (where applicable) Owner's insurers, test agencies, and governing authorities. Objectives to include:
   01 Review foreseeable methods and procedures related to roofing work. Tour representative areas of roofing substrates (decks), inspect and discuss condition of substrate, roof drains, curbs, penetrations, and other preparatory work performed by other trades.
   02 Review structural loading limitations of deck and inspect deck for loss of flatness and for required attachment.
   03 Review roofing systems requirements (drawings, specifications, and other contract documents).
   04 Review required submittals, both completed and yet to be completed.
   05 Review and finalize construction schedule related to roofing work and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   06 Review required inspection, testing, certifying, and material usage accounting procedures.
   07 Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions, including possibility of temporary roofing (if not a mandatory requirement).
   08 Record (contractor) discussion of conference, including decisions and agreements (or disagreements) reached, and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.
   09 Review notification procedures for weather or non-working days.

1.5 QUALITY ASSURANCES

A. Work and materials hereinafter specified shall be best of kind described and, unless specified otherwise, shall be new and of best quality.
   01 All roofing materials utilized in performance of each type of work shall be the products of one manufacturer of supplier.

B. Materials will be securely fastened in place in a watertight, neat and workmanlike manner.
   01 All workmen shall be thoroughly experienced in the particular class of work upon which employed.
   02 Work shall be performed in accordance with these specifications and shall meet the approval in the field of the Architect.

C. Contractor shall plan and conduct the operations of the work so that each section started on one day is complete, details installed and thoroughly protected before the close or work for that day.

D. Unless otherwise indicated, the materials to be used in this specification are those specified and denote the type, quality, performance, etc. required.
   01 All proposals shall be based upon the use of the specified material.

E. Application of materials shall be in accordance with the manufacturer's standards and recommendations.
   02 In the instance of a conflict between these specifications and those of the manufacturer, the most stringent shall take precedence.

F. In compliance with IBC-2018 the roofing system manufacturer shall meet ASCE 7-05 wind uplift requirements and shall meet Underwriter's Laboratory Class "A" Fire Rating.

G. The roof system shall pass 500 cycles of ASTM D5849 Resistance to Cyclic Joint Displacement (fatigue) at 14° F (-10° C).
   01 Passing results shall show no signs of membrane cracking or interplay delamination after 500 cycles.
   02 Manufacturer to provide written compliance with this test to be acceptable.

H. Certificate of Analysis: provide manufacturers printed Certificate of Analysis for all materials used and attach with Final Warranty.

I. Fire watch inside the building is required for all torch applied roofing.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer's original unopened packaging with all tags and labels intact and legible.
   01 Carton and can labels shall indicate appropriate warning, storage conditions, lot numbers, and usage instructions.
   02 Handle and store materials and equipment in such a manner as to avoid damage.

B. Store all materials in a dry location protected from damage and dirt, not on roof. Store all materials in an on-site storage container or other Siplast approved method. The Architect and Owner's on-site roof inspector must do monitoring of stored material. All violations to be reported to CFISD's Project Manager.

C. Products liable to degrade as a result of being frozen shall be maintained above 40° F in heated storage.

D. The proper storage of materials is the sole responsibility of the contractor.
   01 Materials damaged in shipping or storage shall not be used.
   02 Wet or damaged roofing materials shall be discarded, removed from job site, and replaced with new materials prior to application.

E. No storage of materials shall be permitted on roof areas other than those materials that are to be installed the same day. In no case shall material be stored on the existing roof. Any exception must be in written form.
   01 Do not place materials or equipment in such a manner as to overload structure.
   02 Handle and store materials or equipment in a manner to avoid significant or permanent deflection of deck.

1.7 FIELD REPRESENTATION

A. Manufacturer's Field Representative: An authorized, technical agent of the roofing manufacturer shall be assigned to the project to conduct field observations during the installation phase.
   01 In as much as possible, the originally assigned field representative shall remain consistent for all site visits and observations.

B. Regularly scheduled, on site observations shall be required by the manufacturer's field representative a maximum of every fourth working day during the roofing installation period; exceptions being made for inclement weather, holidays, etc.
   01 Manufacturer's representative shall notify the Contractor and Architect's field representative of scheduled site visits a minimum of 24 hours in advance.

C. Observation reports shall include the following:
   01 Written report / documentation of the installation progress at the time of the site visit.
   02 The report shall include documentation of any issues / questions and how the issue(s) were resolved.
   03 The report shall include record of directives given to the roofing contractor
   04 Digital photographic documentation of the roofing progress; including documentation of specific issues and areas / details in question.
   05 Each report shall contain project name, Bay-IBI project number, date / time / duration of site visit,

D. In addition to the progress observations, the manufacturer's representative must:
   01 Attend the roofing trade start-up meeting;
   02 Approve the application of the foundation coats,
   03 Approve the application of reinforcing fabric components,
   04 Approve the application of completed finish coats.

E. All observation reports shall be kept current and shall be delivered electronically to the Contractor and Architect within five (5) calendar days after the observation.

Progress payments for roofing work may be withheld if observation report submissions are not current.

F. After completion of all roofing work, and prior to acceptance of the roofing installation, manufacturer's representative shall conduct an observation to document all roofing work to be corrected as a condition of acceptance.
   01 Each item requiring corrective work shall be identified (including specific location) and required corrective action shall be noted.
   02 The final observation report must be produced in writing with photographic back-up. Marking corrective items on the roof alone shall not be acceptable.

1.8 ADDITIONAL REPRESENTATION AND INSPECTION REQUIREMENTS

A. Full-time observation by Owner's Roofing Consultant is required for all new roofs and reroofing work.

B. Installation of Base Ply, P-20 sheet, P-30 sheet, roof flashing material (i.e. veral), must be monitored 100% full time by Owner's Roofing Consultant. Roof Consultant shall report directly to Owner Project Manager and Architect.

C. Installation of entire roofing system shall be monitored by the Owner's Roofing Consultant. Owner's Roofing Consultant shall report to the CFISD Project Manager on progress and provide daily reports to the Contractor. Owner's Roofing Consultant does not have the responsibility of providing corrective direction to the Contractor.

D. The Architect, Owner Project Manager and Manufacturer Representative shall review each phase of the roofing installation. Architect shall schedule / coordinate visits by the Manufacturer Representative.

1.9 PROJECT CONDITIONS

A. Weather Condition Limitations: Do not apply roofing membrane during inclement weather or when a 40% chance of precipitation is expected.

B. Do not apply roofing insulation or membrane to damp deck surface.

C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

D. Proceed with roofing work only when existing and forecasted weather conditions will permit unit of work to be installed in accordance with manufacturer's recommendations and warranty requirements.

1.10 SEQUENCING AND SCHEDULING

A. Sequence installation of modified bituminous sheet roofing with related units of work specified in other sections to ensure that roof assemblies, including roof accessories, flashing, trim, and joint sealers, are protected against damage from effects of weather, corrosion, and adjacent construction activity.

B. All work must be fully completed on each day. Phased construction will not be accepted. Roof must be thoroughly protected before the close of work for that day.

1.10 DESIGN AND PERFORMANCE CRITERIA

A. Uniform Wind Uplift Load Capacity:
   01 All roofing and roofing assemblies shall be installed as required to meet the specified wind loads, IBC-2018 requirements and all applicable codes and ordinances of local authorities having jurisdiction.

B. The manufacturer and roofing contractor shall verify all requirements prior to submission of bid.

1.11 WARRANTY

A. Modified Bitumen Roofing – Manufacturer: Project shall be installed in such a manner that the roofing material manufacturer will furnish a written 20 year full system warranty for the completed roofing assembly.
   01 Warranty will be a “no dollar limit/no penal sum” labor and material warranty, with total replacement cost.
   02 No exclusion for ponded water.
   03 Manufacturer will warranty all components of the roof system, including new lightweight insulating concrete decks, all new insulation, if any, and all flashings and sheet metal in writing.

B. Roofing Contractor: The contractor, jointly with any subcontractors employed by him, shall guarantee the work required and performed under this contract will be free from defects in workmanship and materials, and that the building will be and remain waterproof for a five (5) year warranty period, after the Architect accepts the work as substantially complete.
   01 The warranty shall be in approved notarized written form, to obligate the Contractor, and subcontractors, to make good the requirements of the warranty.
   02 The warranty shall be held jointly with the Bonding Company for the first two (2) years and the manufacturer for the remaining three (3) years.

C. Sheet Metal: Contractor shall provide a five (5) year written warranty for all sheet metal.
   01 Warranty shall cover defects in materials and workmanship for the warranty period.
   02 Contractor shall provide a manufacturer’s 20 year material warranty.

D. Membrane manufacturer will provide an annual inspection for the life of the warranty.
   01 Upon completion of annual inspection, provide a written summary to the Owner, including overall status of roofing and potential deficiencies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The design and specification for the Modified Bitumen Membrane Roofing system is based on roofing systems manufactured by Siplast.

2.2 GENERAL

A. All materials shall be manufactured, specified, or accepted in writing by membrane manufacturer issuing the warranty.
   01 Proposed materials shall ensure full system warranty from said manufacturer.
   02 Installer shall be an applicator licensed by the manufacturer.

B. Samples of all materials used on the project, which are not supplied by the membrane manufacturer, shall be submitted to the membrane manufacturer for written approval prior to starting work.

C. All materials used on the project shall be asbestos-free.

2.3 BITUMINOUS MATERIALS

A. Asphalt Primer: V.O.C. compliant, ASTM D41.

B. Asphalt Roofing Mastic: V.O.C. compliant, ASTM D2822, Type II.

C. Asphalt: Shall meet ASTM Specification D312 Type IV.

D. Elastomer: V.O.C. compliant, Trowelable asphalt elastomeric mastic.

E. Flashing Coating: A Gilsonite based aluminum roof coating.

2.4 ROOF MEMBRANE MATERIAL

A. Roofing Membrane Assembly: A roof membrane assembly consisting of two plies of a prefabricated, reinforced, homogeneous Styrene-Butadiene-Styrene (SBS) block copolymer modified asphalt membrane, applied over a prepared substrate. Reinforcement mats shall be impregnated/saturated and coated each side with SBS modified bitumen blend and coated one side with a torch grade SBS bitumen blend adhesive layer. The adhesive layer shall be manufactured using a process that embosses the surface with a grooved pattern to provide optimum burn-off of the plastic film and to maximize application rates. The cross sectional area of the sheet material shall contain no oxidized or non-SBS modified bitumen. The roof system shall pass 500 cycles of ASTM D 5849 Resistance to Cyclic Joint Displacement (fatigue) at 14°F (-10°C). Passing results shall show no signs of membrane cracking or interply delamination after 500 cycles. The roof system shall pass 200 cycles of ASTM D 5849 after heat conditioning performed in accordance with ASTM D 5147. The assembly shall possess waterproofing capability, such that a phased roof application, with only the modified bitumen base ply in place, can be achieved for prolonged periods of time without detriment to the watertight integrity of the entire roof system.
   a. Approved product: Siplast Paradiene 20 TG/30 FR TG BW torchable roof system

   01 Modified Bitumen Base and Stripping Ply:
      a. Thickness (avg): 114 mils (2.9 mm) (ASTM D 5147)
      b. Thickness (min): 110 mils (2.8 mm) (ASTM D 5147)
      c. Weight (min per 100 ft² of coverage): 76 lb (3.7 kg/m²)
      d. Maximum filler content in elastomeric blend: 35% by weight

e. Low temperature flexibility @ -15ºF (-26ºC): PASS (ASTM D 5147)
f. Peak Load (avg) @ 73ºF (23ºC): 30 lbf/inch (5.3 kN/m) (ASTM D 5147)
g. Peak Load (avg) @ 0ºF (-18ºC): 75 lbf/inch (13.2 kN/m) (ASTM D 5147)
h. Ultimate Elongation (avg.) @ 73ºF (23ºC): 50% (ASTM D 5147)
i. Dimensional Stability (max): 0.1% (ASTM D 5147)
j. Compound Stability (min): 250ºF (121ºC) (ASTM D 5147)
k. Approvals: UL Class listed, FM Approved (products shall bear seals of approval)
l. Reinforcement: fiberglass mat or other meeting the performance and dimensional stability criteria
m. Approved product: Siplast Paradiene 20 - torchable grade

02 Modified Bitumen Finish Ply:
a. Thickness (avg): 138 mils (3.5 mm) (ASTM D 5147)
b. Thickness at selvage (coating thickness) (avg): 118 mils (3.0 mm) (ASTM D 5147)
c. Thickness at selvage (coating thickness) (min): 114 mils (2.9 mm) (ASTM D 5147)
d. Weight (min per 100 ft² of coverage): 112 lb (5.4 kg/m²)
e. Maximum filler content in elastomeric blend: 35% by weight
f. Low temperature flexibility @ -15ºF (-26ºC): PASS (ASTM D 5147)
g. Peak Load (avg) @ 73ºF (23ºC): 30 lbf/inch (5.3 kN/m) (ASTM D 5147)
h. Peak Load (avg) @ 0ºF (-18ºC): 75 lbf/inch (13.2 kN/m) (ASTM D 5147)
i. Ultimate Elongation (avg.) @ 73ºF (23ºC): 55% (ASTM D 5147)
j. Dimensional Stability (max): 0.1% (ASTM D 5147)
k. Compound Stability (min): 250ºF (121º C) (ASTM D 5147)
l. Granule Embedment (max loss): 2.0 grams per sample (ASTM D 5147)
m. Approvals: UL Class listed, FM Approved (products shall bear seals of approval)
n. Reinforcement: fiberglass mat or other meeting the performance and dimensional stability criteria
o. Surfacing: #11 ceramic granules, color: white
p. Approved Product: Sipast Paradiene 30 FR TG BW – torchable grade, color: white

2.5 FLASHING MEMBRANE ASSEMBLY

A. Flashing Membrane Assembly: A flashing membrane assembly consisting of a prefabricated, reinforced, Styrene-Butadiene-Styrene (SBS) block copolymer modified asphalt membrane with a continuous, channel-embossed metal-foil surfacing. The finish ply shall conform to ASTM D 6298 and the following physical and mechanical property requirements.
a. Approved Product: Siplast Veral flashing system, aluminum finish

01 Cant Backing Sheet and Flashing Reinforcing Ply
a. Thickness (avg): 102 mils (2.6 mm) (ASTM D 5147)
b. Thickness (min): 98 mils (2.5 mm) (ASTM D 5147)

c. Weight (min per 100 ft² of coverage): 72 lb (3.5 kg/m²)
d. Maximum filler content in elastomeric blend: 35% by weight
e. Low temperature flexibility @ -15º F (-26º C) - PASS (ASTM D 5147)
f. Peak Load (avg) @ 73ºF (23ºC): 30 lbf/inch (5.3 kN/m) (ASTM D 5147)
g. Peak Load (avg) @ 0ºF (-18ºC): 75 lbf/inch (13.2 kN/m) (ASTM D 5147)
h. Ultimate Elongation (avg.) @ 73ºF (23ºC): 50% (ASTM D 5147)
i. Dimensional Stability (max): 0.1% (ASTM D 5147)
j. Compound Stability (min - sheet): 250ºF (121ºC) (ASTM D 5147)
k. Compound Stability (min – adhesive coating): 212ºF (100ºC) (ASTM D 5147)
l. Approvals: UL Class listed, FM Approved (products shall bear seals of approval)
m. Reinforcement: fiberglass mat or other meeting the performance and dimensional stability criteria
n. Back Surfacing: polyolefin film
o. Approved Product: Sipast Paradiene 20 SA

02 Metal-Clad Modified Bitumen Flashing Sheet
a. Thickness (avg): 142 mils (3.6 mm) (ASTM D 5147)
b. Thickness (min): 138 mils (3.5 mm) (ASTM D 5147)
c. Weight (min per 100 ft² of coverage): 92 lb (4.5 kg/m²)
d. Coating Thickness – back surface (min): 40 mils (1 mm) (ASTM D 5147)
e. Low temperature flexibility @ 0º F (-18º C): PASS (ASTM D 5147)
f. Peak Load (avg) @ 73ºF (23ºC): 85 lbf/inch (15 kN/m) (ASTM D 5147)
g. Peak Load (avg) @ 0ºF (-18ºC): 180 lbf/inch (31.7 kN/m) (ASTM D 5147)
h. Ultimate Elongation (avg) @ 73ºF (23ºC): 45% (ASTM D 5147)
i. Tear-Strength (avg): 120 lbf (0.54 kN) (ASTM D 5147)
j. Dimensional Stability (max): 0.2% (ASTM D 5147)
k. Compound Stability (min): 225ºF (107ºC) (ASTM D 5147)
l. Cyclic Thermal Shock Stability (maximum): 0.2% (ASTM D 7051)
m. Approvals: UL Approved, FM Approved (products shall bear seals of approval)
n. Reinforcement: fiberglass scrim mat or other meeting the performance and dimensional stability criteria
o. Surfacing: aluminum metal foil
p. Approved Product: Sipast Veral Aluminum

B. Catalyzed Acrylic Resin Flashing System: A specialty flashing system consisting of a liquid-applied, fully reinforced, multi-component acrylic membrane installed over a prepared or primed substrate. The flashing system consists of a catalyzed acrylic resin primer, basecoat and topcoat, combined with a non-woven polyester fleece. The resin and catalyst are pre-mixed immediately prior to installation. The use of the specialty flashing system shall be specifically approved in advance by the membrane manufacturer for each application.
a. Approved Product: Parapro 123 Flashing System by Siplast; Irving, TX

2.6 ROOFING SHEET METAL

A. Refer to Section 07 62 00 – Sheet Metal Flashing.

2.7 RELATED MATERIALS

A. Roofing Adhesives:
   01 Mopping Asphalt: Asphalt that has been certified for full compliance with the requirements for Type IV asphalt listed in Table I, ASTM D312.
   02 Each container or bulk shipping ticket shall indicate the equiviscous temperature EVT, the finished blowing temperature, FBT, and the flash point, FP.
      a. Approved product: PA-100 asphalt.
   03 Cold Process Adhesive: A blend of special adhesive asphalts and safe, high flash, quick drying solvents that meets or exceeds ASTM D4479, Type II requirements.
      a. Approved Product: PA-311R Adhesive.
   04 Insulation and cover board Adhesive: A single component, moisture cured, polyurethane foam adhesive, dispensed from a portable, pre-pressurized container used to adhere insulation other insulation panels.
      a. Approved Product: Para-Stik Insulation Adhesive by Siplast; Irving, TX

B. Bituminous Cutback Materials:
   01 Primer: A high flash, quick drying, asphalt solvent blend which meets or exceeds ASTM D41 requirements.
      a. Approved product: PA-1125 Asphalt Primer.
   02 Mastics: asphalt cutback mastic, reinforced with non-asbestos fibers, used as a base for setting metal flanges and conforming to ASTM D4586 Type II requirements.
      a. Approved product: PA-1021 Plastic Cement.
   03 Primer for Self-Adhesive Sheets: A quick drying, low-VOC, water-based, high-tack primer specifically designed to promote adhesion of roofing and waterproofing sheets to approved substrates. Primer shall meet South Coast Air Quality District and Ozone Transport Commission requirements.
      a. Approved product: TA-119 Primer by Siplast; Irving, TX

C. Caulking and Sealants: A single component, high performance, elastomeric sealant. Acceptable types are as follows:
   01 PS-209 Elastomeric Sealant: Self leveling caulk for flanges and edge metal
   02 PS-715 NS Elastomeric Sealant: Vertical applications

D. Ceramic Granules: No. 11 BW Grade Specification Ceramic granules. Color: Bright White

E. Fiber Cant and Tapered Edge Strips: Performed rigid insulation units of sizes/shapes indicated, matching insulation board or of perlite or organic fiberboard, as per the approved manufacturer.

F. Fasteners:

01 Shall be approved and as recommended by the manufacturer for the specified application.

02 Fastener for Brick: Shall be ¼" x 2", stainless steel nail, one piece unit, flat head as manufactured by Rawl Zamac Nailin, or approved equal.

03 Fastener for Wood: Shall be a #14 fastener, fluorocarbon coated, with CR-10 coating. A minimum 0.200 inch diameter shank and 0.250 inch diameter thread. To be used with approved, round pressure plates or bar, and having a fluorocarbon CR-10 coating, when subjected to 30 Kesternich cycles (DIN 50018) shows less than ten percent (10%) red rust as manufactured by Olympic Manufacturing Group, Inc., or pre-approved equal.

04 Base sheet Over Lightweight Concrete Deck: Shall be a split shank, one fastener to be used with a 2 ¾" bilateral perforated metal plate, both G-90 galvanized for non-corrosiveness as manufactured by Siplast, or approved equal.

05 Nails: Stainless steel, ring shank, size as required to suite application minimum 11 gauge with 3/8 inch diameter head.

06 Insulation Fasteners: Insulation fasteners and plates shall be FM Approved, and/or approved by the manufacturer of the primary roofing products. The insulation fasteners shall provide attachment required to meet the specified uplift performance and to restrain the insulation panels against the potential for ridging. The fastening pattern for each insulation panel to be used shall be as recommended by the insulation manufacturer and approved by the manufacturer of the primary roofing products. Acceptable insulation fastener manufacturers for specific deck types are listed below.

a. Metal Decks: Insulation mechanical fasteners for metal decks shall be factory coated for corrosion resistance. The fastener shall conform meet or exceed Factory Mutual Standard 4470 and when subjected to 30 Kesternich cycles, show less than 15% red rust. Acceptable insulation fastener types for metal decks are listed below.

1) A fluorocarbon coated screw type roofing fastener having a minimum 0.220 inch thread diameter. Plates used in conjunction with the fastener shall be a metal type having a minimum 3 inch diameter, as supplied by the fastener manufacturer.

2) Approved Product: Parafast Fastener by Siplast; Irving, TX

G. Walkway Pads: A prefabricated, puncture resistant polyester core reinforced, polymer modified bitumen sheet material topped with a ceramic-coated granule wearing surface meeting the following physical and mechanical requirements:

01 Thickness: 0.217 inch – (5.5 mm).

02 Weight: 1.8 lb. /ft² - (8.8 kg/m²).

03 Width: 30 inches – (76.2 cm).

04 Approved Product: "Paratread" Roof Protection Material.

H. Gypsum Sheathing Panel (cover board): A panel composed of a gypsum based, non-structural water resistant core material integrally bonded with fiberglass mats on both sides having a nominal thickness of 1/2 inch. The panel surface shall be factory primed with a non-asphaltic primer.

01 For use at lightweight insulating concrete repair.

02 Acceptable types are as follows:

a. DensDeck Prime Gypsum Roof Board, by Georgia Pacific Corporation; Atlanta, GA.
b. USG Securock Brand Gypsum-Fiber Roof Board, by United States Gypsum Company; Chicago, IL

2.8 MISCELLANEOUS MATERIALS AND ACCESSORIES

A. Other materials shall be as shown, specified or required and be of the best grade for the proposed use as recommended by the manufacturer.

B. Sealant Backer Rod: Provide compressible rod stack of polyethylene foam, polyurethane foam, polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable, non-absorptive material as recommended by sealant manufacturer for back-up of and compatibility with sealant. Where used with hot-applied sealant, provide heat-resistant type which will not be deteriorated by sealant application temperature as indicated.

C. Sealants: A moisture-curing, non-slump elastomeric sealant designed for roofing applications. The sealant shall be approved by the roof membrane manufacturer for use in conjunction with the roof membrane materials. Acceptable types are as follows:
a. Siplast PS-209 Elastomeric Sealant by Siplast; Irving, TX

D. Butyl Sealer: Where impractical to use solder at joints, corners, etc., seal with "DAP Butyl Gutter and Lab Sealer" or "Cushion-Lock CL-50 Butyl Sealer".

E. Nails, Rivets and Fastenings: Nails shall be stainless steel ring shank. Rivets shall be stainless steel, 300 Series. Aluminum – flat heat, sized as required.

F. Pipe Hangers and Supports: Provide and install all necessary supports for gas lines, conduit, chilled water lines, duct work, condensate lines, etc. Refer to Division 22 & 23.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate surfaces to receive modified bitumen sheet roofing system and associated work and conditions under which roofing will be installed.
03 Do not proceed with roofing until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

B. Lightweight Insulation Concrete Deck System: Nailable fills shall receive base sheet properly fastened and installed in accordance with local IBC Building Codes and local authorities having jurisdiction.

C. A water test is to occur before the membrane installation occurs to fix bird baths.

D. Sweep or vacuum all surfaces, removing all loose aggregate and foreign substances prior to commencement of roofing. Ensure dry, smooth surface with no depressions or ponding water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Cooperate with manufacturer, inspection and test agencies engaged or required to perform services in connection with installing modified bitumen sheet system.

B. Aesthetic Considerations: An aesthetically pleasing overall appearance of the finished roof application is a standard requirement for this project. Make necessary preparations, utilize recommended application techniques, apply the specified materials (i.e.: granules, metallic powder, etc.) and exercise care in ensuring that the finished application is acceptable to the Owner.

C. Protect other work from spillage of modified bitumen roofing materials, and prevent liquid materials from entering or clogging drains and conductors.
   01 Replace or restore other work damaged by installations of modified bituminous sheet roofing system work.

D. Coordinate installing roofing system components so that insulation and roofing plies are not exposed to precipitation or left exposed overnight.
   01 Provide cut-offs at end of each day's work to cover exposed ply sheets and insulation with two courses of #15 organic felt with joints and edges sealed with roofing cement.
   02 Remove cut-offs immediately before resuming work.

E. Substrate Joint Penetrations: Prevent bitumen from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

F. Apply roofing materials as specified herein unless recommended otherwise by manufacturer's instructions.
   01 Keep roofing materials dry before and during application.
   02 Do not permit phased construction.
   03 Complete application of roofing plies, modified sheet and flashing in a continuous operation.
   04 Begin and apply only as much roofing in one day as can be completed that same day.

G. Asphalt Bitumen Heating: Heat and apply bitumen according to EVT Method as recommended by NRCA.
   01 Do not raise temperature above minimum normal fluid-holding temperature necessary to attain EVT (plus 5 ºF at point of application) more than 1 hour prior to time of application.
   02 Determine flash point, finished blowing temperature, EVT, and fire-safe handling temperature of bitumen either by information from manufacturer or by suitable test.
   03 Do not exceed recommended temperature limits during bitumen heating.
   04 Do not heat to a temperature higher than 25º below flash point.
   05 Discard bitumen that has been held at temperature exceeding finishing blowing temperature (FBT) for more than 3 hours.
   06 Keep kettle lid closed except when adding bitumen.

H. Bitumen; Mopping Weights: For interply mopping, apply bitumen at the rate of approximately 25lb of asphalt per roof square (plus or minus 25 percent on a total job average basis).

3.3 BASE SHEET INSTALLATION

A. Once all debris is removed from the roof substrate, and the deck is found to be in good condition, the contractor shall roll out the vented fiberglass base sheet, channel side down, over the surface.
   01 Lap subsequent sheets 4" over the preceding one and ends 6 inches.
   02 Extend sheet over and down wood blocking or existing fascia and tack in place.
   03 Fasteners and fastening patterns shall be determined by building height, pull out values from lightweight insulating concrete decks in accordance with all codes and requirements.

B. Fastening patterns shall comply with manufacturer's requirements to meet the specified and required win loads, for all areas of the roof plane:
   01 Zone 1 - Field Of Roof
   02 Zone 2 - Roof Perimeter
   03 Zone 3 – Corners

C. Extend sheet over wood blocking and down face; base sheet must extend continuously and evenly throughout the roof plane to provide a tight seal against the penetration of moisture vapor from below.

3.4 ROOF MEMBRANE INSTALLATION

A. Membrane Application: Install roofing in accordance with roofing system manufacturer's current published instructions and the following requirements. Application of roofing membrane components shall immediately follow application of base sheet as a continuous operation.

B. Priming: Prime metal flanges (all jacks, edge metal, lead drain flashings, etc.) and concrete and masonry surfaces with a uniform coating of ASTM D41 asphalt primer.

C. Kettles and Tankers:
   01 Kettles and tankers shall be equipped with accurate, fully readable thermometers.
   02 Do not heat asphalt to or above its flash point.
   03 Avoid heating at or above the FVT, should conditions make this impractical, heating must be no more than 25 degrees F below the EVT and no more than 25 degrees F above the EVT.

D. Asphalt Temperatures: If the EVT information is not provided, the following asphalt temperature shall be observed. Maximum heating temperature shall be 525 degrees F. Minimum application temperature shall be 400 degrees F.

E. Asphalt Mopping: Ensure that all mopping do not exceed a maximum of 25 pounds per square. Mopping shall be total in coverage, leaving no breaks or voids.

F. Membrane Adhesive Application: Apply cold adhesive in a smooth, even, continuous layer without breaks or voids at the rate of 1 ½ gallons per square per ply.
   01 The porosity of some substrates may require a heavier application to ensure full adhesion.)

G. Bitumen Consistency: Cutting or alterations of bitumen, primer, and sealants will not be permitted.

H. Roofing Ply Application:
   01 Apply all layers of roofing free of wrinkles, creases or fishmouths.
   02 Exert sufficient pressure on the roll during application to ensure prevention of air pockets.
   03 Lap seams between the base ply layer and the finish ply layer shall not coincide. Stagger the courses to ensure this.
   04 Apply all layers of roofing perpendicular to the slope of the deck.
   05 Fully bond the base ply to the mechanically attached base sheet with hot asphalt. Each sheet shall have minimum three (3) inch side laps and six (6) inch end laps. Each sheet shall be applied directly behind the asphalt applicator. Staggered end laps a minimum of three (3) feet.
   06 Fully bond the finish ply to the base ply with hot asphalt. Each sheet shall have a minimum of three (3) inch side and end laps. Each sheet shall be applied directly behind the asphalt applicator. Stagger end laps of the finish ply a minimum of three (3) feet. Stagger side laps of the finish ply a minimum of three (3) feet from end laps in the underlying base ply.
   07 Exert sufficient pressure on the metal clad modified bitumen sheet to ensure the prevention of air pockets. This can be accomplished by using a damp, kitchen type sponge mop or a damp, heavy duty cotton nap paint roller.
   08 Prime all end laps of the metal clad modified bitumen sheet with a uniform coating of the specified asphalt primer and allow to thoroughly dry prior to overlapping of adjoining sheets.
   09 Probe laps using a clean, heated roofing trowel and heat fuse dry laps of the metal clad modified bitumen sheet to ensure a complete seal.
   10 Using clean, heated roofing trowel, lightly crimp the foil surfacing over the membrane edges (approximately 1/8-1/4 inch width along the side and end laps of the metal clad modified bitumen sheet.
   11 Maximum sheet lengths and special fastening of the specified roof membrane system may be required at various slope increments where the roof deck slope exceeds ½ inch per foot. The manufacturer shall provide acceptable sheet lengths and the required fastening schedule for all roofing sheet applications to applicable roof slopes. Cold process adhesives shall be used on slopes over ½ inch per foot up to and including six (6) inches per foot.

I. Granule Embedment: Broadcast mineral granules over all bitumen overruns on the finish ply surface, while the bitumen is still hot, to ensure a monolithic color.

3.5 FLASHING INSTALLATION

A. General:
   01 Flashings shall be installed using the manufacturer's Veral flashing membrane, with length of run not to exceed manufacturer's recommendations.
   02 Wooden nailers or curbs shall be installed at all edges and openings in the roof, mechanically fastened to the deck. The nailers should be of exterior grade wolmanized timber, and of the same thickness as any insulation to be used on the roof.
   03 Cant strips shall be installed at the intersection of the deck and/or all vertical surfaces. Prime all cants.

04 The roofing field membrane shall extend up over and to the top of cant strips at all vertical intersections or out the roof's edge.
05 All substrates receiving flashing membrane shall be clean and primed with asphalt primer, prior to application.
06 All flashings and flashing cleats shall be mechanically fastened a maximum of 6" O.C., shall be a minimum of 8" above adjacent roof height, shall extend a minimum of 9" onto the field of horizontal roof membrane, and shall not exceed 10 LF in length.
07 Provide termination bars at the top of vertical flashings, fastened a maximum of 6" O.C.
08 Install flashing membrane in accordance with drawings and/or material manufacturer's guarantee requirements, whichever is the most stringent.

B. Flashing Application – Masonry Surfaces:
01 Flash masonry parapet walls and curbs using the reinforcing sheet and the metal foil flashing membrane.
02 After the base ply has been applied to the top of the cant, fully adhere the reinforcing sheet, utilizing minimum 3" side laps and extend a minimum of 3" onto the base ply surface and 3" up the parapet wall above the cant.
03 After the final roofing ply has been applied to the top of the cant, prepare the surface area that is to receive flashing coverage by torch heating granular surfaces or by application of asphalt primer; allowing primer to dry thoroughly.
04 Torch apply the metal foil-faced flashing into place using 36" widths (cut off the end of roll) always lapping the factory selvage edge.
05 Stagger the laps of the metal foil flashing layer from lap seams in the reinforcing layer. Extend the flashing sheet a minimum of 4" beyond the toe of the cant onto the prepared surface of the finished roof and up the wall to the desired flashing height.
06 Exert pressure on the flashing sheet during application to ensure complete contact with the wall/roof surfaces, preventing air pockets; this can be accomplished by using damp sponge or shop rag. Check and seal all loose laps and edges. Nail the top edge of the flashing on 9" O.C..

C. Flashing Application – Wood Surfaces:
01 Inspect the nailer to assure proper attachment and configuration.
02 Flash wood or plywood parapet walls and curbs using the reinforced sheet and metal foil flashing membrane.
03 The reinforcing sheet shall have minimum 3" side laps and extend a minimum of 3" onto the base ply surface and to the top of the parapet wall, curb, etc.
04 Nail the reinforcing sheet through the field of the sheet to the vertical wood surface 12" O.C. from the top of the cant tot the top of wall curb, etc.
05 Fully adhere the remainder of flashing reinforcing sheet that extends over the cant and roof level.
06 After the finish ply has been applied to the top of the cant, prepare the surface area that is to receive primer to dry thoroughly.
07 Torch apply the metal foil-faced flashing into place using 36" widths (cut off the end of roll) always lapping the factory selvage edge.
08 Extend the flashing sheet a minimum of 4" beyond the toe of the cant onto the prepared surface of the finished roof and up the wall to the desired flashing height.

09 Exert pressure on the flashing sheet during application to ensure complete contact with the wall/roof surfaces, preventing air pockets; this can be accomplished by using a damp sponge or shop rag.
10 Check and seal all loose laps and edges.
11 Nail the top edge of the flashing 9" O.C.

D. Projection Flashing:
01 Plumbing Vents: soil vent stack pipes shall receive lead flashings installed in accordance with practices set forth in the NRCA Roofing Manual. The lead shall be carried up and over the top of the stack, and crimped down into the pipe to form a watertight seal. Projections shall be flashed as recommended by the roof membrane manufacturer. Provide tapered edge strips around base. Strip-in flange with specified stripping.
02 Square Projections: strip in all flanges on square projections wit specified stripping ply. Prime all flanges prior to setting in a bed of mastic. Install to manufacturer's specifications. Provide tapered edge strips around base. Cricket up-side slope.
03 Round Projections: Strip in all flanges on round projections with specified stripping ply. Prime all metal prior to setting in mastic. Install to manufacturer's specifications. Provide tapered edge strips around base.

E. Wall and Curb Flashings:
01 The flashing substrate shall be free of all dirt and loose material.
02 The underlayment ply of plies shall be brought to the top of the cant strip and adhered.
03 Starting on the roof at least 6" from the roof side edge of the cant strip, adhere two (2) plies of flashing extending over the cant and up the vertical a minimum of 8".
04 Each lap of the ply sheet shall be a minimum of 3".
05 Starting two (2) inches past the flashing plies, install one (1) ply of SBS flashing membrane in hot asphalt.
06 Laps shall not coincide with previously installed plies.
07 The top of the SBS flashing shall be 1" past the previously installed plies above the cant strip.
08 Fasten the top edge of the flashing on 6" centers using approved termination bar and fasteners.
09 An NRCA-approved metal counterflashing shall extend down over the flashing a minimum of 4".
10 Cricket the up-side slope of all curb projections.

F. Overnight Seal/Water Out-Off:
01 Over Night Seal: Shall be performed according to accepted roofing practice as outlined in the NRCA Roofing Manual.
02 Water Cut-Off: At the end of day's work or when precipitation is imminent, construct a water cut-off at all open edges.
03 Cut-offs can be built using asphalt or plastic cement and roofing felts, constructed to withstand protracted periods of service.
04 Cut-offs must be completely removed prior to resumption of roofing.

3.6 PITCH POCKET WITH UMBRELLA AND FLANGED PENETRATIONS

A. Run all plies up to the penetration.

B. Pitch pans shall be at least 4" deep. The pitch pocket should extend at least 1" beyond the penetration in all directions. All corners and seams should be soldered tight and watertight.

C. Place the pitch pocket over the penetration and prime all flanges.

D. Strip in flange of pitch pocket with one ply of base ply. Extend 6" onto field of roof.

E. Install second layer of stripping membrane extending 9" onto field of roof.

F. Install modified roof membrane.

G. Fill pitch pan half full with non-shrink grout. Let this cure and top off with elastomer.

H. Caulk joint between roof system and pitch pan with roof cement.

I. Place a water-shedding bonnet over the top of the pitch pocket and clamp the top with a draw-band collar. Caulk the upper edge of the band with sealant.

3.7 FLASHING MEMBRANE INSTALLATION

A. All curb, wall and parapet flashings shall be sealed with an application of mastic and mesh on a daily basis. No condition should exist that will permit moisture entering behind, around, or under the roof or flashing membrane.

B. Prepare all walls, penetrations and expansion joints to be flashed and where shown on the drawings, with asphalt primer at the rate of one gallon per 100 square feet Allow primer to dry tack free.

C. The two ply modified flashing system will be used as the flashing membrane and will be adhered to the underlying substrate by heat fusing unless otherwise noted in these specifications and nailed off 8” O.C. at all vertical surfaces.

12 All base flashing shall extend up wall or curb in the machine direction of the membrane. All base flashing shall be terminated with a termination bar at 8” O.C.. and sealed at the top with a three course application of asphalt mastic and PVC mesh.

D. The entire sheet of flashing membrane must be solidly adhered to the substrate.

E. Counter flashing, cap flashings, expansion joints, and similar work to be coordinated with modified bitumen roofing work are specified in other sections.

F. Roof accessories, miscellaneous sheet metal accessory items, including piping vents and other devices to be coordinated with modified bituminous roof system work are in other sections.

3.9 ROOF METAL AND ACCESSORIES

A. Refer to Section 07 72 00 – Roof Accessories.

B. Coordinate all interfacing work as required to meet requirements of roofing manufacturer.

3.10 FINAL INSPECTION

A. At completion of roofing installation and associated work, meet with Installer, installer of associated work, Architect, roofing system manufacturer's representative, and other representatives directly concerned with performance of roofing system.

B. Walk roof surface areas of the building, inspect perimeter building edges as well as flashing of roof penetrations, walls, curbs and other equipment. List all items requiring correction or completion and furnish copy of list to each parting attending.

C. The Roofing System Manufacturer reserves the right to request a thermographic scan of the roof during final inspection to determine if any damp or wet materials have been installed. The thermographic scan shall be provided by the Roofing Contractor at a negotiated price.

D. If core cuts verify the presence of damp or wet materials, the Roofing Contractor shall be required to replace the damaged areas at his own expense.

E. Repair or replace (as required) deteriorated or defective work found at time above inspection to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

F. The Contractor is to notify the Owner upon completion of corrections.

G. Following the final inspection, acceptance will be made in writing by the material manufacturer.

3.11 CLEANING AND PROTECTION

A. Leave all areas around job site free of trash, debris, roofing materials, equipment, and related items after completion of job.

B. Remove bitumen stains from walls, walkways and driveways.

C. Finished roof areas shall be protected from damage by the contractor during construction.

END OF SECTION

SECTION 07 62 13

SHEET METAL FLASHING

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide all sheetmetal flashing and metal thru-wall flashing as indicated on the Drawings and required for a complete installation.
   02 Perimeter roof edge flashing (Fascia cover) to be per section 07 71 00 – Roof Specialties

C. Include all shop and field formed sheet metal work shown on drawings, specified or required, including, but not limited to:
   01 Roof penetration sleeves, hood and umbrella counterflashing.
   02 Metal counterflashing and thru-wall flashing.
   03 Expansion joints.
   04 Roof Drains
   05 Metal perimeter soffit trim.
   06 Gutters, downspouts, and splash pans.
   07 Metal thru-wall flashing receiver
   08 Copings, trim and miscellaneous sheet metal flashing and accessories.

D. Related Work:
   01 Section 03 52 16.19 – Lightweight Insulating Concrete.
   02 Section 05 31 00 – Steel Decking.
   03 Section 07 41 13 – Metal Roof Panels.
   04 Section 07 52 00 – Modified Bituminous Membrane Roofing
   05 Section 07 71 00 – Roof Specialties
   06 Section 07 72 00 – Roof Accessories.
   07 Section 07 72 23 – Roof Hatches and Vents.
   08 Section 13 34 19 – Metal Building Systems.
   09 All sections of Work relating to or affecting the roof system, including mechanical, plumbing and electrical items.

E. All work shall be coordinated with the specified roofing system in accordance with roofing system manufacturer's standards and requirements.
   01 Sheet metal flashing shall be included as a component of the roofing system warranty.
   02 Be performed by the roof membrane contractor.

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

E. Color / Finish Samples:
   01 Provide two (2) samples of each finish for selection by the Architect.
   02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
   03 Minimum size shall be 3" x 3", but must be large enough to convey attributes of the proposed product.

1.3 REFERENCES

A. American Society of Testing and Materials (ASTM):
   01 ASTM A653/A653M-06 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   02 ASTM A792/A792M Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
   03 ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   04 ASTM E283 Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
   05 ASTM E331 Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
   06 ASTM E646 Standard Test Method for Tensile Strain-Hardening Exponents (n -Values) of Metallic Sheet Materials.
   07 ASTM E1592 Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
   08 ASTM E1680 Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems.
   09 ASTM E2140 Standard Test Method for Water Penetration of Metal Roof Panel Systems by Static Water Pressure Head.

B. National Association of Architectural Metal Manufacturers (NAAMM).

C. National Roofing Contractors Association (NRCA):

01 Roofing and Waterproofing Manual.

D. Sheet Metal and Air Conditioning Contractors National Associate, Inc. (SMACNA):
01 Architectural Sheet Metal Manual.

E. ANSI / SPRI / FM 4435 / ES-1 “Wind Test Design Standard for Edge Systems Used with Low Slope Roofing Systems”

1.4 QUALITY ASSURANCE

A. Single source responsibility: Fabricator of roof-related flashing and accessories shall be from a single source supplier.
01 Provide products from an acceptable manufacturers with a minimum of five (5) years of satisfactory experience in sheetmetal flashing fabrication.

B. Sheet metal flashing that interfaces with the roofing system shall be installed by the roof installer.
01 Coordinate as required for proper installation and interface in accordance with the roofing system manufacturer.
02 Coordinate all sheetmetal flashing associated with the specified roof system with the roof manufacturer and installer to assure compatibility.
03 Where roofing membrane or cap sheet is adhered to the sheetmetal flashing, provide primer, surfacing or other coating as required by the roofing manufacturer for proper interface and adherence to the roofing warranty requirements.

C. Comply with governing codes and regulation of authorities having jurisdiction.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver, handle and store materials in accordance with manufacturer’s instructions.

B. Handle and store materials and equipment in such a manner to avoid damage.
01 All damaged materials shall be removed from site and replaced with new fabrications.

C. No storage of materials shall be permitted on roof areas other than those materials that are to be installed the same day.
01 Any exception must be in written form.
02 Do not place materials or equipment in such a manner as to overload structure.

1.6 WARRANTY

A. Roofing Contractor’s Warranty:
01 Contractor shall warrant the sheet metal work and related work to be free from defects in workmanship and materials, and that the metal flashings will be and remain watertight, for a period of five (5) years from date of Substantial Completion.
02 Defects shall include, but not be limited to:
a. Leaking water or bitumen within building or construction.

b. Becoming loose from substrate.
c. Loose or missing parts.
d. Finish failure as defined above.

03 Correction may include repair or replacement of failed products.

04 Warranty shall state that defects of the sheet metal occurring during the warranty period that cause damage to the building interior or exterior shall be promptly addressed by the contractor within a maximum of forty-eight (48) hours after notification.

B. Manufacturer's Product Finish Warranty:

01 Manufacturer's standard twenty (20) year Kynar 500 or Hylar 5000 Finish warranty signed by the manufacturer, guaranteeing covering failure of the fluoropolymer finish during the warranty period.

02 Failure is defined to include, but not be limited to:

a. Deterioration of finish, such as fading, discoloring, peeling, cracking, corroding, etc.

03 Correction shall include replacement of defective / failed products.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers / fabricators providing sheetmetal flashing shall meet or exceed the following requirements:

01 Their products meet or exceed the specifications.

02 Fabricator has a minimum of five (5) years' experience manufacturing products of the type specified.

03 Products have been tested in conjunction with roofing system as an assembly and as such have obtained the same approval and rating as the roofing membrane system.

04 Products are approved for use by the roofing system manufacturer.

B. Manufacturers / fabricators shall coordinate with the roofing system manufacturer to assure compatibility and proper interface with the roofing system manufacturer's standards and requirements.

2.2 SHEET METAL MATERIALS

A. General Requirements: roofing sheet metal system shall have been tested in conjunction with roofing system as an assembly and have the same approval and rating as the roofing system.

B. Stainless Steel:

01 Conforming to ASTM A167 and A240/A240M.

02 Type 302/304 Soft Temper.

03 No. 2D finish.

04 Minimum thickness 24 gauge, except as otherwise noted.

C. Prefinished Aluminum Sheet:

01 Precoated type, aluminum conforming to Fed. Spec. QQ-A-250, ASTM B209

02 Finish: Kynar 500 or Hylar 5000 in color as specified by Architect from manufacturer's standard colors.

03 Thickness: minimum 0.040 inch, except as otherwise indicated.

D. Sheet Lead:
   01 Comply with FS QQ-L-201, Grade B.
   02 Four (4) pound minimum for use as sanitary vent flashing.
   03 Four (4) pound minimum for use at roof drains and soil stacks.

E. Finish: Finish for all exposed sheetmetal work shall be a premium, factory applied / baked on PVDF paint finish using a Kynar 500 resin base, containing a minimum of 70% floropolymer, meeting AAMA 2605-98 standards.
   01 BASF “Fluoroceram”.
   02 PPG Industries “Duranar”.
   03 The Velspar Corporation “Fluopon”.
   04 Color on finish side shall be as selected by the Architect from the manufacturer’s custom / premium colors to match existing finish. Color on concealed side shall be manufacturer’s option.
   05 Provide a strippable, protective coating material on all finished portions of pre-finished flashing; to be removed following installation.

F. All sheet metal fascia, gutters and downspouts shall be pre-finished aluminum. All metal flashing embedded in roof membrane and in through-wall conditions shall be stainless steel.

2.3 FASTENERS

A. Fasteners shall be same metal as flashing/sheet metal, or other non-corrosive metal as recommended by sheet manufacturer for the specific application. Match finish of exposed heads with material being fastened.

A. Exposed fasteners shall be self-sealing and gasketed for weather tight installation. (ZAC type).

B. Match finish of exposed heads with material being fastened.

C. Mechanical fasteners:
   01 Nails: Stainless steel, ring-shank, minimum 1-1/2 inches in length with ½ inch diameter head.
   02 Washers: steel washers with bonded rubber sealing gasket.
   03 Screws: self-tapping sheet metal type of stainless steel or compatible with material being fastened, with integral EPDM washers.
   04 Rivets: stainless steel and cadmium plated material, closed end type of sizes recommended by sheet metal manufacturer to suit application.
   05 Provide 300-series stainless steel.

D. Clips: Clips should be minimum 0.050-inch aluminum or 20 gauge stainless steel.

2.4 RELATED MATERIALS

A. Solder: ASTM B32, flux type and alloy composition as required and recommended by the manufacturer for the metals to be soldered.

B. Flux:
   01 Phosphoric acid type, manufacturer’s standard.
   02 For use with stainless steel: acid-chloride type flux, except use rosin flux over tinned surfaces.

C. Adhesives: type recommended by flashing sheet manufacturer seaming and adhesive application of flashing sheet to ensure adhesion and water tightness.

D. Metal Accessories: sheet metal clips, straps, anchoring devices, clamps and similar accessories required for the complete installation of work, matching or compatible with material being installed, non-corrosive, size and gauge recommended by installer to suit application and performance.

E. Sealant:
   01 Type A:
      a. Type: one-part, non-sag, moisture-curing polyurethane sealant.
      b. Approved Products/Manufacturers: "Chem-Calk 900" manufactured by Bostik Construction Products Division, "Vulkem 921" manufactured by Mameco International, Inc., "Dynatrol 1" manufactured by Pecora Corporation, "NP 1" manufactured by Sonneborn Building Products, or approved equal.
   02 Type B:
      a. Type: one-part, neutral-curing, medium-modulus silicone sealant for sealing metal to metal surfaces, i.e. metal edge, cover plates, etc.
      b. Approved Products/Manufacturers: "Chem-Calk 1200" manufactured by Bostik Construction Products Division, "795 Silicone Building Sealant" manufactured by Dow Corning Corporation, "895 Silicone" manufactured by Pecora Corporation, "Omniseal" manufactured by Sonneborn Building Products, "Spectrem 2" manufactured by Tremco Incorporated, or approved equal.

F. Pitch Pan Filler:
   01 Type: pourable polyurethane sealer, approved by roofing system manufacturer.
   02 Approved Products/Manufacturers: "Quick Pitch Sealer" manufactured by U. S. Intec, "SPM Pourable Sealer" manufactured by Johns Manville, or approved equal.

G. Termination Bar:
   01 Material: extruded aluminum bar with flat profile.
   02 Size: 1/8 inch thick by one (1) inch wide with factory punched ¼" x 3/8" oval holes spaced six (6) inches on center.
   03 Approved Products/Manufacturers: "TB 125" manufactured by TruFast Corp. or approved equal.

H. Pipe Hangers and Supports: Refer to Section 07 72 00 – Roof Accessories.

I. Splash Pans: 22-gauge stainless steel, of size an profiles indicated. Use at locations where roof drainage discharges onto lower roof.

J. Splash blocks: concrete, type, of size and profiles indicated; minimum 3,000 psi compressive strength at 28 days, with minimum five (5) percent air entrainment. Use at locations where roof drainage dumps on ground.

K. Thru-wall flashing receiver: 24 ga. 2D finish

L. Downspout Boots:

01 Approved products: Cast Aluminum by Barry Pattern & Foundary; Style B25A or Cast Iron by Neenah Foundry Company, Series R-4929 or pre-approved equal.
02 Provide downspouts boots in size and configuration as shown on drawings or as required for pipe sizes and down spout sizes. Minimum 36" length.
03 Separate dissimilar metal, where applicable.

2.5 FABRICATION

A. Except as otherwise indicated, fabricate work in accordance with SMACNA Architectural Sheet Metal Manual and other recognized industry practices and reviewed shop drawings. Form all flashings, receivers and counter flashings in accordance with standards set forth in the NRCA roofing manual and SMACNA.

B. Comply with manufacturer's installation instructions and recommendations.

C. Shop fabricate work to greatest extent possible. Fabricate inside and outside corners for metal edges, counterflashing, and coping caps.

D. Fabricate items to size and dimensions as indicated on the drawings. Limit single-piece lengths to ten (10) feet.

E. Fabricate for waterproof and weather-resistant performance; with expansion provisions for running work sufficient to permanently prevent leakage, dame or deterioration of the work.

F. Integrate flashing in a manner consistent with detailing. Form work to fit substrates.

G. Make angle bends and folds for interlocking metal with full regard for expansion and contraction to avoid buckling of fullness in metal after installation.

H. Fabricate items with straight lines, sharp angles, smooth curves, and true levels. Avoid tool marks, buckling and oil canning.

I. Fold back edges on concealed side f exposed edge to form hem.

J. Unless noted otherwise, lap joints minimum one (1) inch. Rivet and solder joints on parts that are to be permanently and rigidly assembled.

K. Seams:
01 Wherever possible, fabricate non-moving seams in sheet metal with flat-lock seams and end joints.
02 Pre-finished metal: seal pre-finished metal seams with rivets and silicone sealant.
03 Metal other than aluminum: tin edges to be seamed, form seams, and solder.

L. On Kynar 500 or Hylar 5000 pre-finished metal, surface sand flanges prior to applying any primers. Prime all metal in contact with bituminous material.

M. Back paint all concealed metal surfaces with bituminous paint where expected to be in contact with cementitious materials or dissimilar metal.

N. Expansion Provisions: where lapped or bayonet type expansion provisions in work cannot be used or would not be sufficiently waterproof or weatherproof, form expansion joints of intermeshing hooked flanges, not less than one (1) inch deep filled with mastic sealant concealed within joints.

O. Unless noted otherwise, fabricate, gutters, downspouts, copings, and trim from pre-finished aluminum sheet. Gutters shall slope to downspout location(s).

P. Fabricate corners from one piece with maximum 48 inch long legs. Seam and seal prefinished steel, solder stainless steel.

2.6 FABRICATED ITEMS

A. Metal Flashings:
   01 Through wall receiver tray: minimum 24 gauge stainless steel. Fabricate receiver tray to full depth of wall cavity, solder all joint and end dams.
   02 Counterflashing: minimum 24 gauge stainless steel, unless otherwise shown on drawings.

B. Wind Clips: minimum 24 gauge stainless steel (or match material of counterflashing), one (1) inch wide by length to engage counterflashing a minimum of ½ inch.

C. Roof Penetrations:
   01 Umbrella counterflashing: two-piece construction of minimum 22 gauge stainless steel, fabricated in accordance with drawings or project requirements.
   02 Flashing pans:
      a. 24 gauge stainless steel.
      b. Fabricate to provide installed minimum clear inside perimeter dimension of two inches on each side of penetration element.
      c. Fabricate pans to at least six inches above the finished roof membrane and with ¼ inch hem at tope edge and with four inch flanges. Round all corners of flange.
      d. Fabricate metal bonnets for all pans, NO EXCEPTIONS. Fabricate bonnets with metal compatible with metal to which bonnet is to be attached. On beams and other steel, weld in place bonnets fabricated from /4 inch steel plate. Draw band bonnets fabricated from 22 gauge stainless steel may be used on circular projections.

D. Soffit Trim:
   01 Minimum 0.040 inch thick pre-finished aluminum to match roof edge flashing (fascia cover). Reference section 07 71 00 – Roof Specialties

E. Vent Hoods, Sleeves, Penetration Flashings, and Accessories: minimum 24-gauge stainless steel, or as shown or directed otherwise.

F. Coping:
   01 0.040” thick pre-finished aluminum, with standing seam joints of same profile.

02 Fabricate as outlined in SMACNA; refer to Figure 3-4A.
03 Provide tapered substrate to slope to one side and cover with waterproof membrane.
04 Install with continuous cleat on front side and fasten 6" o.c..

G. Pipe Box Cover: 24-gauge stainless steel.

H. Heat Exhaust Curbs and Hoods: 22-gauge stainless steel.

I. Expansion joint cover: Shop-built, minimum 24 gauge, standing-seam, stainless steel. Provide pre-finished aluminum metal at perimeter edge and termination. Last 10 feet of expansion joint to match color of gravel guard.

J. Angle Termination Bar: 1" x 1" x 0.040" aluminum

K. Vent Pipe Flashing: 4 lb. lead. Provide proper size to fold down inside of pipe a minimum of 1". Caulk top of vent prior to folding lead in.

L. Roof Drain Flashing: 4 lb. lead minimum 30" x 30"

M. Thru-wall Flashing Receiver: Stainless Steel 24 gauge, 2D finish.
01 Ten foot (10'-0") lengths with 6" cover plates bedded in caulk.
02 Corners 24" max., 18" min., weld or solder.
03 Two (2) inch leg turned up the back wall and flashed.

N. Interval Roof Drain Gutter/Trench: 18 gauge stainless.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify substrates are smooth and clean to extent required to perform sheet metal work.

B. Verify roof openings, curbs, pipes, sleeves, ducts or vents through roof are solidly set in place.

C. Verify that reglets, nailers, cants, and blocking to receive sheet metal are in place and free of concrete and soil.

D. Do not start work until conditions are satisfactory.

3.2 PREPARATION

A. Field measure site conditions prior to fabrication work.

B. Install starter and edge strips and cleats before starting installation.

3.3 INSTALLATION

A. Install sheet metal with lines, arises, and angles sharp and true, and plane surfaces free from objectionable wave, warp, or buckle. Exposed edges of sheet metal shall be folded back to form ¼" hem on concealed side from view. Finished work shall be free from water retention and leakage under all weather conditions. Pre-fabricated corners or transitions are required at changes in direction,

elevation, or place and at intersections. Locate field joints not less than 12" nor more than 3' from actual corner. Laps shall be 1", riveted and soldered at following locations:

01 Pre-fabricated corners.
02 Transitions.
03 Changes in direction, elevation, and plan.
04 At intersections.

B. Anchor units of work securely in place to prevent damage or distortion from wind or buckling. Provide for thermal expansion of metal units; conceal fasteners wherever possible, and set units true to line an level as indicated. Install work with laps, joints, and seams which are permanently watertight and weatherproof.

C. Install fabricated sheet metal items in accordance with manufacturer's installation instruction and recommendations and with SMACNA Architectural Sheet Metal Manual.

D. Separations: provide for separation of metal from dissimilar metal or corrosive substrates by coating concealed surfaces with zinc chromate, bituminous coating, or other permanent separation locations of contact as recommended by manufacturer of fabricator. Do not use materials which are incompatible with roofing system.

E. Continuous cleat: at exposed edges of perimeter edge, fascias, cap flashings, and where required, attaché continuous cleat at 6" on center with appropriate fastener.

F. Gravel guard/fascia:

01 Install with expansion joints 10' on center, ½" expansion leeway, with cover plate.
02 Set in asphalt mastic and fasten into nailer at 3" on center, staggered.
03 Buff sand Kynar surface of flange and prime.
04 Strip in flange with specified stripping plies in hot bitumen extending 6" from the outer edge of the flange and butt base of gravel stop.

G. Counterflashing:

01 Do not use surface mount counterflashing.
02 Set in through wall with receiver and spring lock counterflashing, as detailed in drawings and to NRCA roofing manual, SMACNA standards.
03 Coordinate installation of through wall flashing with the masonry contractor.
04 Seal through wall in conjunction with masonry wall waterproofing.
05 Install wind clips 30" on center at all counterflashing over 5' in length.
06 Do not stair step flashing unless reviewed and approved by Architect.

H. Pitch Pans:

01 Apply mastic under pitch pan flange at least ½ pound per linear foot.
02 Prime all metal flanges with asphalt primer prior to flashing installation.
03 Clean all projection enclosed in pitch pans in any manner suitable and coated with a rust inhibitive coating as approved by the Architect. Coating shall be allowed to dry prior to pitch pan fill.
04 Fill base of pitch pans with grout or cementitious binder and allow to cure.
05 Top finish fill: self-leveling, one part urethane, at least 2" to top of itch pan sides.

06 Strip in flange with specified stripping plies in hot bitumen extending 6" from the outer edge of the flange and butt base of pitch pan.

I. Roof Drains:
01 After membrane installation, prime bottom of lead flashing sheet and set in uniform bed of plastic roof cement at specified locations.
02 Extend lead flashing into drain bowl or pipe a minimum of 2" and over top of piping/bowl connections, if possible. Apply a continuous bead of specified Type A sealant, at intersection of pipe and drain bowl.
03 If drain bowl and pipe connection is contaminated with bituminous materials, strip-in area with 3 coursing of plastic roof cement and fabric.
04 Prime top of lead flashing sheet to receive strip-in membrane.

J. Pipe Box:
01 Fully solder joints and connections.
02 Height shall be 6" minimum above roof surface.
03 Install with flanges set in plastic roof cement on roof membrane.
04 Fill pans with grout to a height of ¾" of the total pan height.
05 Fill remaining height of pitch pans with specified pitch pan filler.
06 Install hood over pan securing to each side with self-tapping screws.
07 Install face plate to cover box opening around pipe penetrations.

K. Sanitary Vent Stacks:
01 Prime top and bottom flanges of lead flashing sleeve. Set flange in uniform troweling of plastic roof cement. Prime top side of flange to receive strip-in membrane.
02 Fold lead sleeve down inside of pipe a minimum of 1". Apply a continuous bead of sealant on inside of pipe prior to folding lead sleeve.

L. Expansion Joint:
01 Construct wood curbs as shown on drawings using materials specified in Section 07 52 00 – Modified Bituminous Membrane Roofing or if not specified there, use materials specified in Section 06 10 00– Rough Carpentry.
02 Install underlayment, form envelope, and secure underlayment to curb. Fill envelope with compressible insulation.
03 Securely fasten expansion joint cover to curb with grommet type fasteners spaced 6" on center.
04 Taper expansion joint down at the metal edge.
05 Shall be installed as detailed on drawings and as outlined in the NRCA Roofing Manual and SMACNA.

M. Coping:
01 Install wood nailers as shown on drawings.
02 Install metal cleats with appropriate fasteners spaced 6" on center.
03 Install underlayment over the wood substrate. Lap ends minimum of 6" and secure membrane in place. Seal laps with appropriate adhesive.
04 Install metal coping allowing ½" spaces between segments.
05 Lock coping onto cleat and install appropriate fasteners through the interior fascia space 24" on center in enlarged holes.
06 Install appropriate fastener through neoprene washer and cover plate between coping segments.
07 Accommodate building wall expansion joints by terminating coping joints and cleats either side of expansion joint. Do not run coping or cleats continuous across joints. Install coping cover plate to span across joint

and lap coping on each side of joints a minimum of 4". Fasten cover plate on one side of joint only. Provide wall flashing membrane up and over parapet wall in accordance with manufacturer's detail.

3.4 CLEANING AND PROTECTION

A. Remove flux and residual acid immediately by neutralizing with baking soda and washing with clean water. Leave work clean of stains.

B. Remove scraps and debris and leave work area clean.

C. Clean exposed metal surfaces, removing substances which might cause corrosion of metal or deterioration of finishes. Paint areas where finish is damaged on pre-finished metal by painting with a compatible paint in color to match undamaged finish.

D. Prime soldered area of phosphitized metal after cleaning to prevent rusting.

E. Paint metal flashings that have been soiled with bitumen with aluminized paint.

F. Clean other work damaged or soiled by Work of this Section.

G. Protect finished work from damage.

END OF SECTION

SECTION 07 65 26

SELF-ADHERING SHEET FLASHING

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide self-adhering sheet flashing at exterior walls to transition from one assembly to another as required to provide a continuous, sealed building envelope.
   02 Locations include, but are not limited to:
      a. Masonry / brick ledges.
      b. All openings through exterior walls.
      c. Wall to roof transition.
      d. As indicated on the Drawings.

C. Related Work:
   01 Section 04 20 00 – Unit Masonry
   02 Section 06 10 00 – Rough Carpentry
   03 Section 07 53 60 - Modified Bituminous Membrane Roofing
   04 Section 07 62 00 – Sheet Metal Flashing
   05 Section 08 80 00 – Glazing
   06 Section 09 21 16 – Gypsum Board Assemblies

1.2 SUBMITTALS

A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.

B. Manufacturer’s specifications and other data needed to prove compliance with specified requirements.

C. Certification of compatibility with weather barrier specified in Section 07 25 00 – Weather Barrier.

D. Manufacturer’s installation instructions; including Shop Drawings where necessary to detail special conditions.

E. Sample Panel: Sample panel shall be 8' long x 6' high panel showing completed through-wall flashing at first course of masonry and dampproofing assembly, complete with exterior sheathing, rigid insulation (where applicable). Coordinate as required with other trades.
   01 Panel shall be “L” shaped (4’ x 4’) with metal stud / drywall back-up wall on one side and CMU back-up on one side.

02 Once accepted by the Architect, the sample panel shall be the standard by which installed is judged.
03 Sample panel shall remain at the jobsite until all through-wall flashing and dampproofing is completed.

1.3 WARRANTY

A. Refer to Section 01 77 00 – Close-Out Procedures.

B. Provide a material and labor, non-prorated, manufacturer / installer minimum two (2) year warranty that material and installation shall remain water tight.

PART 2 - PRODUCTS

2.1 SELF ADHERING SHEET FLASHING MANUFACTURERS

A. Design of self-adhering sheet flashing is based on products manufactured by Henry Company.

B. Acceptable Manufacturers: the following manufacturers are acceptable to provide products of this Section, provided proposed products meet or exceed all specified requirements:
01 Grace Construction Products
02 Polyguard Products, Inc.
03 Tremco

C. Provide primers, glass fabric scrim tape, mastic and other materials not specifically described, as required for a complete and proper installation as recommended by the manufacturer.

2.2 SELF ADHERING SHEET FLASHING

A. By definition for Work covered by this Section, “self-adhering sheet flashing” shall refer to all flexible flashing installed at both through-wall and non-through-wall conditions.
01 Metallic thru-wall flashing shall be as specified in Section 07 62 00 – Sheet Metal Flashing.

B. Flexible, Self-Sealing Wall Flashing:
01 Design of self-adhering sheet flashing is based on Henry Company Blueskin TWF Self-Adhesive Thru-Wall Flashing Membrane.
02 Description: Self-adhering, membrane consisting of an SBS rubberized asphalt compound which is integrally laminated to a cross laminated polyethylene (HDPE) film, with a silicone release sheet, specifically designed for thru-wall flashing conditions.
03 Width: Select either 12 inch, 18 inch, 24 inch, 36 inch wide rolls.
04 Thickness: 40 mils. Film thickness: 9 mils.
05 Elongation: 200% minimum (ASTM D412 Die C).
06 Water vapor transmission: 0.03 perms (ASTM E96 Method B).
07 Membrane tensile strength: 800 psi minimum.

C. Primers and Sealants:
01 Provide primers as recommended by the manufacturer for the specific substrate, condition and assembly.
02 Provide sealants as recommended by the manufacturer for the specific substrate, condition and assembly.

D. Termination Bar: Provide where indicated on the Drawings.
   01 1” x 1/8” aluminum or stainless steel flat bar.
   02 Pre-drilled to fasten at maximum 16” O.C.
   03 Fasteners shall be cadmium plated or 300 series stainless steel, self-tapping screws.

PART 3 - EXECUTION

3.1 PREPARATION

A. Working Conditions: Apply under normal working conditions above 45°F and rising. Do not apply when rain is imminent.

B. Storage: Keep container tightly sealed and protect from freezing in shipping and storage.

C. Surface Preparation:
   01 All dust, dirt, old loose or scaling coatings shall be removed from the surface before coating or application of thru-wall flashing.
   02 All brick ledge conditions shall be free of dirt and dust prior to application of thru-wall flashing.
   03 All cracks, joints, penetrations, and splits should be sealed, repaired with 4 inch wide glass fabric scrim tape embedded in Henry Company #789.
   04 Dusty or porous masonry surfaces should be dampened with water. Highly porous masonry should be primed with Henry Company #788 Asphalt Primer or #351 Non-fibered Emulsions which has been thinned with 1 gallon water per 5 gallons of #788.
   05 Metal surfaces shall be free of rust, cleaned and primed.
   06 Architect shall approve the taping of joints and surface preparation prior to the application of the dampproofing.

3.2 LOCATIONS

A. Self-Adhering Sheet Flashing:
   01 All foundation masonry / brick ledges. At locations where adjacent concrete flatwork is above the bottom of the brick ledge, two (2) layers shall be applied – one at base of brick ledge and one at the first brick course above the adjacent flatwork.
   02 Over heads of openings on steel lintel angles back to wall sheathing / substrate.
   03 Under sills and at jambs of openings (not thru wall). Install additional thru-wall flashing at window jambs to lap over the end dams of all sub-sill flashing. Coordinate with window installer as required.
   04 At perimeter of building at roof lines and parapets (not thru wall) extending down onto exterior walls (sheathing or CMU as applicable).
   05 At all exterior wall conditions as required to divert moisture within wall cavities to the building exterior.
   06 At all openings through exterior sheathing / CMU resulting from structural steel or other interfacing work.
   07 Bridging building expansion joints that telegraph into exterior back-up wall substrate.
   08 Where indicated on Drawings.

B. Termination Bar: Continuous at the top edge of the vertical surface of all thru-wall flashing at all masonry ledges, wall-to-roof masonry conditions and masonry lintels.

C. The completed installation of thru-wall flashing shall render the building water tight except at door and window openings.

3.3 INSTALLATION – SELF-ADHERING SHEET FLASHING

A. Install all self-adhering sheet flashing and dampproofing in strict accordance with the manufacturer's specifications and recommendations.
   01 Take all necessary precautions to eliminate fish-mouths and other irregularities. Where they occur, cut out and apply additional layer(s) of thru-wall flashing as required to achieve a smooth surface.
   02 Carefully construct corner assemblies and vertical transitions / steps to assure proper lapping of adjacent sheets to provide positive drainage. Lap joints shall be a minimum of 4 inches.
   03 All thru-wall flashing shall be installed prior to application of dampproofing.

B. Do not extend self-adhering sheet flashing at masonry / brick ledges and lintels to face of masonry. Cut back 1/2" to 3/4" from exterior face.

C. Carefully coordinate with the Masonry Contractor to install thru-wall flashing at the proper brick course(s). Thru-wall flashing shall form a continuous barrier at all transitions.

3.4 TESTING AND INSPECTING

A. Not more than ten (10) days after completion of this portion of the Work, at the discretion of the Architect, demonstrate by running water test that the Work of this Section will successfully repel water.
   01 Notify the Architect at least 48 hours in advance, and conduct the test in the Architect's presence.
   02 By means of an outrigger, or similar acceptable equipment, place the nozzle of a 3/4 inch garden hose at a point approximately 10'-0" away from top of wall where approved by the Architect, aiming the nozzle at slight downward angle to direct full stream of water onto wall.
   03 Run water onto wall at full available force for not less than four hours.
   04 Upon completion of the four-hour period, inspect interior surfaces of wall for evidence of moisture penetration.

B. If evidence of moisture penetration is discovered, apply an additional coat of dampproofing to the exterior surface in areas directed by the Architect. Repeat application and testing at no additional cost to the Owner, until no evidence of moisture penetration is found.

END OF SECTION

SECTION 07 71 00

ROOF SPECIALTIES

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers

B. Scope of work: Provide roof speciailites as indicated on the drawings, including, but not limited to:
   01 Preperation of surfaces to receive factory fabrication metal perimeter.
   02 Installation of factory fabricated and finished metal perimeter.

C. Related Work:
   01 Section 03 52 16.19 - Lightweight Insulating Concrete
   02 Section 06 10 00 - Rough Carpentry
   03 Section 07 52 00 - Modified Bituminous Membrane Roofing
   04 Section 07 62 13 – Sheet Metal Flashing
   05 Section 07 65 26 – Self-Adhering Sheet Flashing

1.2 REFERENCE STANDARDS

A. NRCA - National Roofing Contractors Association, Rosemont, IL

B. OSHA - Occupational Safety and Health Administration, Washington, DC

C. SMACNA - Sheet Metal and Air Conditioning Contractors National Association, Chantilly, VA

D. FM - Factory Mutual Engineering and Research, Norwood, MA

E. ANSI - American National Standards Institute, Washington, DC

F. SPRI - Single Ply Roofing Industry, Waltham, MA

1.3 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
   01 Product data shall include test certificates / reports, other certifications and applicable documentation to demonstrate compliance and as required by the specification.

C. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.

01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface with adjacent assemblies / materials depicted in the assembly(s) indicated on the Drawings.
02 Generic details that do not depict actual conditions shall not be acceptable.
03 Where blocking is required, clearly indicate type, size and location; and coordinate with other trades as required for proper installation

D. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
01 Include recommended cleaning products and instructions for use.
02 Where applicable, provide recommended maintenance schedules and procedures.

E. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
01 Show profiles, sizes, spacing and locations of assembly components.
02 Show details of shop fabrications, connections and details.
03 Show details of field fabrications, connections and details.
04 Provide calculations demonstrating compliance with wind load and other design / code requirements.
05 Shop drawings shall be sealed and signed by a Texas registered engineer.

F. Certifications:
01 Provide letter from manufacturer, signed by an officer, stating the installer is licensed and / or certified by the manufacturer to provide the installation.
02 Certification of Class A roof system.
03 Submit certification that the roof system furnished is Tested and Approved by Factory Mutual Standard No. 4470 as a Class 1 roof assembly with 1-90 Wind Uplift Requirements.
04 Certified copy of ISO 9002 compliance.

G. Design Loads: Submit copy of manufacturer's minimum design load calculations according to ASCE 7-05, Method 2 for Components and Cladding, sealed by a registered professional engineer employed by the system manufacturer as a full-time staff engineer.
01 In no case shall the design loads be taken to be less than those required by applicable codes and authorities having jurisdiction.

H. Operations and Maintenance Manuals
01 Provide complete operations and maintenance manuals to the Owner.
02 Refer to section 01 78 23 – Operations and Maintenance Manuals
03 O & M manuals must be reviewed, accepted and delivered to the Owner prior to Owner demonstration(s).

I. Warranty:
01 Provide one (1) sample of each warranty proposed to be furnished.
02 Sample copy of the roofing system manufacturer's inclusion addendum offering coverage of the factory fabricated metal perimeter system(s) as part of the roofing membrane system.

J. Submit a letter from the roofing membrane manufacturer confirming that the factory fabricated metal accessory systems furnished for the project are supplied or manufactured by the roofing membrane manufacturer and that each component section is labeled with the roofing membrane manufacturer's logo.

K. Provide samples from the manufacturer/supplier sized to represent metal components.

L. Provide copies of the manufacturer/supplier's color selection chart showing the manufacturer/supplier's full range of standard colors as well as physical samples of each standard color.

1.4 QUALITY ASSURANCE

A. Agency Approvals: The proposed factory fabricated metal component shall conform to the following requirements. No other testing agency approvals will be accepted.
   01 The roof perimeter fascia system shall be certified through third party verification by the manufacturer/supplier to meet performance design criteria according to the most recent edition of ANSI/SPRI/FM 4435/ES-1: Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.
   02 Verify the Windstorm Classification for the appropriate metal component dimensions and gauge per the third party testing agency's ANSI/SPRI/FM 4435/ES-1 test report for the specificed factory fabricated metal roof perimenter systems.

B. The work to be performed under this specification shall include but is not limited to the following: Attend necessary job meetings and furnish competent and full time supervision, experienced mechanics, all materials, tools, and equipment necessary to complete, in an acceptable manner, the factory fabricated metal installation in accordance with this specification. Comply with the latest written application instructions of the manufacturer/supplier of the factory fabricated metal components.

C. Local Regulations: Conform to regulations of public agencies, including any specific requirements of the city and/or state of jurisdiction.

D. Manufacturer Requirements:
   01 Ensure that the factory fabricated metal components are labeled with the roofing membrane manufacturer's logo.
   02 Ensure that the factory fabricated metal component manufacturer/supplier provides direct trained company personnel to attend necessary job meetings, perform periodic inspections as necessary, and conducts a final inspection upon successful completion of the project.

1.5 PRODUCT DELIVERY STORAGE AND HANDLING

A. Delivery: Deliver materials in the manufacturer's original packaging.

B. Storage: Store materials out of direct exposure to the elements.

C. Strippable Film Masking: Do not remove the strippable film masking on the metal component until immediately following installation. Do not allow extended UV or heat exposure to metal components covered with strippable film masking.

D. Damaged Material: Any materials that are found to be damaged will be automatically rejected, removed and replaced at the Contractor's expense.

1.6 WARRANTY

A. Roof Membrane Warranty: In addition to the specified guarantee under section 07 52 00, furnish the Owner with the roofing manufacturer's inclusion addendum to the guarantee offering coverage of the factory fabricated extruded fascia systems under the standard terms of the roofing system guarantee.

PART 2 - PRODUCTS

2.1 DESCRIPTION OF FACTORY FABRICATED METAL SYSTEMS

A. Factory Fabricated Fascia: Fascia components shall be factory formed according to the requirements of the membrane manufacturer and labeled with the roofing manufacturer's logo. The fascia system shall consist of the following components:
   01 An extruded aluminum anchor bar with pre-punched slotted fastening holes, secured using stainless steel hex head fasteners provided by the manufacturer.
   02 Pre-formed EPDM anchor bar spacers.
   03 A factory formed exterior fascia, fabricated from minimum .040" aluminum with Kynar™ finish. Color to be selected from Manufacturer's standard and express color lines.
   04 Factory formed folded miters and end caps.
   05 Color: as selected by Architect from Manufacturer's standard and custom colors.
   06 Paraguard Extruded Edge AT System, by Siplast, Inc., Irving, TX (800) 922-8800

B. Factory Fabricated Fascia Extender: Factory fabricated fascia extender components shall be factory formed according to the requirements of the membrane manufacturer and labeled with the roofing manufacturer's logo. The fascia extender system shall consist of the following components:
   01 A factory formed cleat with pre-punched nail holes fabricated from 24 gauge, G90 galvanized steel, secured using galvanized ringshank roofing nails.
   02 A factory formed exterior fascia extender with pre-punched nailing holes, secured using galvanized roofing nails. Fabricated from minimum .040" aluminum with Kynar™ finish. Color to be selected from Manufacturer's standard and express color lines.
   03 Factory formed concealed splice plates.
   04 Factory formed welded miters.
   05 Color: as selected by Architect from Manufacturer's standard and custom colors.
   06 roform Fascia Extender, by Siplast, Inc., Irving, TX (800) 922-8800

PART 3 - EXECUTION

3.1 PROJECT/SITE CONDITIONS

A. Requirements Prior to Job Start
   01 Related Work: Verify that all related work performed by other trades is complete prior to installing the factory fabricated metal components.
   02 Component Substrate Condition: Mounting surfaces shall be straight and secure and provide adequate widths to properly support the factory fabricated metal components.

B. Protection Requirements
   01 Component Protection: Protect newly applied factory fabricated metal component surfaces against mechanical damage.
   02 Debris Removal: Remove all debris daily from the project site.

3.2 SUBSTRATE PREPARATION

A. Perimeter Nailers: Perimeter nailers shall be flat and level to the building perimeter edge. The front edge of the nailer must be flush with the outside face or wall of the building. Anchor all perimeter nailers in strict accordance with the guidelines set forth in FM Global Property Loss Prevention Data Sheet 1-49.

B. Flashing Membrane Installation: Ensure that all roofing flashing treatments used in conjunction with factory fabricated metal components are installed according to the roofing membrane manufacturer's specifications, current technical guide, and details prior to installation of the factory fabricated metal component.

C. Surface Cleaning: Sweep or vacuum all surfaces to receive the metal components, removing all loose aggregate, soil, and foreign substances prior to installation of the factory fabricated metal components.

3.3 FACTORY FABRICATED METAL COMPONENT INSTALLATION

A. Install metal components in accordance with the roofing/waterproofing manufacturer's instructions and the following requirements.

B. Factory Fabricated Fascia
   01 After completion of the installation of the roofing membrane plies, apply a three inch wide, 1/4 inch thick band of the roofing manufacturer’s specified mastic or sealant to the underside of the flange of the extruded aluminum anchor bar. Install the anchor bar joint spacer into the end of the extruded aluminum anchor bar to allow the next section to fit properly over the anchor bar joint spacer. Secure the extruded aluminum anchor bar to the perimeter nailer in accordance with the roof system manufacturer's installation instructions.
   02 Beginning again at the corners, hook the top of the exterior fascia onto the top of the extruded aluminum anchor bar and apply slight pressure downward until the fascia engages over the bottom of the extruded aluminum anchor bar. Position the next section to overlap the preceding section approximately 1 inch at the notches provided. Install sections of the fascia cover from right to left as viewed from the rooftop engaging the fascia cover over the anchor bar in the same method as previously described.

C. Factory Fabricated Fascia Extender
   01 Anchor the continuous galvanized clip to the wall surface fastened at 12 inches on center.
   02 Hook the drip edge of the fascia extender over the continuous clip. Use joint splice plates behind adjoining sections of fascia extender. Fasten the top flange of the fascia extender at 12 inches on center. Allow a 3/8 inch gap between fascia extender sections for thermal movement.

3.4 FIELD QUALITY CONTROL AND INSPECTIONS

A. Site Condition: Leave all areas around the job site free of debris, construction materials, equipment and related items after completion of job.

B. Issuance Of The Addendum to the Roofing Membrane/System Guarantee: Complete all post installation procedures and meet the factory fabricated metal manufacturer/supplier's final endorsement for issuance of the addendum to the specified roofing/waterproofing guarantee.

END OF SECTION

SECTION 07 72 00

ROOF ACCESSORIES

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work: Provide roof accessories as indicated on the Drawings, including, but limited to:
   01 Roof equipment curbs.
   02 Expansion joints.
   03 Roof equipment supports.
   04 Pipe supports.
   05 Roof ladders.

C. Related Work:
   01 Section 05 12 00 – Structural Steel Framing.
   02 Section 05 21 00 – Steel Joist Framing.
   03 Section 07 31 00 – Steel Decking.
   04 Section 07 52 00 – Modified Bitumen Membrane Roofing.
   05 Section 07 72 23 – Roof Hatches and Vents.

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.
   04 Provide calculations demonstrating compliance with wind load and other requirements.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01 Include recommended cleaning products and instructions for use.
   02 Where applicable, provide recommended maintenance schedules and procedures.

F. Operations and Maintenance Manuals:
   01 Provide complete operations and maintenance manuals to the Owner.
   02 Refer to section 01 78 23 – Operations and Maintenance Manuals.
   03 O & M manuals must be reviewed, accepted and delivered to the Owner prior to Owner demonstration(s).

1.3 INSTALLATION RESPONSIBILITY

A. In addition to the items normally a part of this Section, coordinate the installation of roof accessory curbs and pipe flashings and equipment supports that may be specified elsewhere.

B. Coordinate the work specified herein with the following work:
   01 Roofing.
   02 Roofing Sheet Metal.
   03 Mechanical Equipment.
   04 Plumbing.
   05 Light Weight Insulating Concrete.

PART 2 - PRODUCTS

2.1 PREFABRICATED ROOF CURBS

A. Design of roof curbs is based on products manufactured by Thybar Corporation.

B. Acceptable manufacturers: The following manufacturers are acceptable to provide Roof Curbs provided proposed product(s) meet or exceed all specified requirements.
   01 The Pate Co.
   02 Custom Curb, Inc.

C. Curbs: Design is based on Thybar model TC-3 series roof curbs.
   01 Manufactured of galvanized steel meeting ASTM A653 / A653M.
   02 Construction Gauge: Minimum 16 gauge; and heavier where required by size and / or load of equipment. Coordinate as required.
   03 All seams shall be welded continuous to be water and air tight.
   04 Roof curb perimeter shall have a continuous 2" minimum horizontal leg at base for secure attachment to supporting steel framing.
   05 Height: As required to provide a minimum 8" above highest interfacing roof deck. Coordinate with roofer to confirm.
   06 Curbs shall be fabricated for level tops, accounting for pitch of roof steel framing / roof deck as required.
   07 Provide additional angle reinforcing at maximum 48" O.C. as required to support equipment.
   08 All curb walls shall be insulated with minimum 1-1/2" thick 3PCF rigid insulation. Provide interior, protective, sheetmetal liner to cover rigid insulation.
   09 Factory installed wood nailers; minimum 1-1/2" x 1-1/2".

D. Counterflashing Cap: Minimum 18 gauge stainless steel.

E. Coordinate with other trades as required for exact sizes of roof curbs required and load at each location.

F. Pipe Flashing Curbs:
   01 Same type of construction as roof curbs above.
   02 Pipe Seals: ABS cover with graduated neoprene with two (2) stainless steel adjustable clamps per pipe boot.
   03 Coordinated with other trades as required for exact sizes, pipe quantities and pipe diameters.

2.2 EQUIPMENT SUPPORTS

A. Design of equipment supports is based on products manufactured by Thybar Corporation.

B. Acceptable manufacturers: The following manufacturers are acceptable to provide Roof Curbs provided proposed product(s) meet or exceed all specified requirements.
   01 The Pate Co.
   02 Custom Curb, Inc.

C. Equipment Supports: Design is based on Thybar model TEMS-3 series equipment supports.
   01 Manufactured of galvanized steel meeting ASTM A653 / A653M.
   02 Construction Gauge: Minimum 18 gauge; and heavier where required by size and / or load of equipment. Coordinate as required.
   03 Nominal width: 5”.
   04 All seams shall be welded continuous to be water and air tight.
   05 Equipment supports perimeter shall have a continuous 2” minimum horizontal leg at base for secure attachment to supporting steel framing.
   06 Height: As required to provide a minimum 8” above highest interfacing roof deck. Coordinate with roofer to confirm.
   07 Equipment supports shall be fabricated for level tops, accounting for pitch of roof steel framing / roof deck as required.
   08 Internal bulkhead reinforcement as required for imposed load.
   09 Factory installed, treated 2x6 wood nailer, continuous.

D. Counterflashing Cap: Minimum 18 gauge stainless steel.

E. Coordinate with other trades as required for exact sizes of roof curbs required and load at each location.

2.3 PIPE SUPPORTS

A. Design of pipe supports is based on products manufactured by PHP Systems / Design (PHPSD). No substitutions.

B. Design of pipe supports is based on PHPSD Pipe Supports as follows:
   01 Series SS-8 for lines 2-1/2” or less.
   02 Series PP-10 for lines up to 3-1/2”.
   03 Series RB-18 for lines 4” to 6”.

C. Roller type pipe support specifically designed for installation without roof penetrations or flashing.

D. Base Material: high density / high impact polypropylene with integral UV protection.

E. Minimum 12 gauge, channel type steel framing with roller system. Hot dipped galvanized after fabrication.

F. Provide accessory clamps, bolts, nuts, washers and other devices required for a complete installation.

G. Provide protective traffic pads at each pipe support as recommended by roofing system manufacturer. Coordinate with other trades as required.

H. Spacing of hangers not to exceed 6 feet on center.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate all trades as required for proper design, sizing and locations of equipment curbs and equipment supports.
   01 Coordinate with steel fabrication and erection contractors to provide a continuous bearing all 4 sides of equipment curbs. Minimum size: 3-1/2x3-1/2 x 1/4" angle.
   02 Coordinate with steel fabrication and erection contractors to provide a continuous bearing all below sides of equipment supports. Minimum size: 3-1/2x3-1/2 x 1/4" angle.
   03 Coordinate with roofing contractor for proper flashing and interface with equipment curbs and supports.

B. Coordinate all trades as required for types, sizing and locations of roof ladder anchoring into exterior walls.
   01 Set anchoring devices in place prior to installation of weather barrier to assure a weather-tight seal at anchors.

3.2 INSTALLATION

A. Install all roofing according in strict accordance with manufacturer's printed instructions and final reviewed shop drawings.

B. Coordinate with roofing operation for flashing and interface to provide a watertight installation.

C. Install sealant conforming to FS TT-S-00227E, Type II, Class A, as required.

END OF SECTION

SECTION 07 72 23

ROOF HATCHES

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope:
   01 Provide roof hatches at locations where indicated on the Drawings.
   02 Provide associated wall anchored access ladders below roof hatches.

C. Related Work:
   01 Section 03 52 16.19 – Lightweight Insulating Concrete
   02 Section 05 12 00 – Structural Steel Framing.
   03 Section 05 21 00 – Steel Joist Framing.
   04 Section 07 31 00 – Steel Decking.
   05 Section 07 52 00 – Modified Bitumen Membrane Roofing.
   06 Section 07 72 00 – Roof Accessories.

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01 Include recommended cleaning products and instructions for use.

02 Where applicable, provide recommended maintenance schedules and procedures.

1.3 QUALITY ASSURANCE

A. Deliver products in manufacturer's original packaging. Store materials in a dry, protected, well-vented area.

B. Installer shall field check conditions and verify the manufacturer's ladder safety post and hatch rail system details for accuracy to fit the application prior to fabrication.

1.4 WARRANTY

A. Provide manufacturer's standard warranty. Materials shall be free of defects in material and workmanship for a period of:
01 Roof hatch: five years
02 Ladder extension: five years
03 Roof rail system: 25 years

B. Defects shall include, but not be limited to, the following:
01 Noticeable deterioration of finish.
02 Leakage of water into the building or within the hatch factory construction / assembly.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The design of roof hatches are based on products manufactured by The Bilco Co.

B. Acceptable Manufacturers: the following manufacturers are acceptable to provide the product(s) of this section, provided proposed products meet or exceed all specified requirements.
01 Babcock-Davis, model BRHT.
02 Milcor, Inc., model Thermal Pro-24
03 Nystrom, model RHT

2.2 MATERIALS – ROOF HATCH

A. Roof Hatch:
01 Design of roof hatches is based on The Bilco Co. model S-50TB single leaf, thermally broken roof hatch assembly.
02 The roof hatch shall be factory assembled, complete; and suitable for direct interface with designed structural support and roofing system.
03 Size: 30" x 36".

B. Performance Characteristics:
01 Cover and curb shall be thermally broken to prevent heat transfer between interior and exterior surfaces.
02 Cover shall be reinforced to support a minimum live load of 40 PSF with a maximum deflection of 1/150th of the span or 20 PSF wind uplift.
03 Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.

04 Operation of the cover shall not be affected by temperature.
05 Entire hatch shall be weather tight with fully welded corner joints on cover and curb.

C. Cover:
01 Shall be 11 gauge aluminum with a 5” beaded flange with formed reinforcing members. Interior and exterior surfaces shall be thermally broken to minimize heat transfer and to resist condensation.
02 Cover shall have a heavy extruded EPDM rubber gasket bonded to the cover interior to assure a continuous seal when compressed to the top surface of the curb.
03 Cover insulation shall be 3” thick polyisocyanurate with minimum R-value of 18, fully covered and protected by 22 gauge galvanized/galvanealed steel liner.

D. Curb:
01 Shall be 12” in height and of 11 gauge aluminum.
02 Interior and exterior surfaces shall be thermally broken to minimize heat transfer and to resist condensation.
03 The curb shall be formed with a 5-1/2” flange with 7/16” holes provided for securing to the supporting structure substrate.
04 The curb shall be equipped with an integral metal cap-flashing of the same gauge and material as the curb, fully welded at the corners, that features the Bil-Clip® flashing system, including stamped tabs, 6” on center, to be bent inward to hold single ply roofing membrane securely in place.
05 Curb insulation shall be 3” thick polyisocyanurate with minimum R-value of 18, fully covered and protected by an 18 gauge aluminum liner.

E. Lifting Mechanism:
01 Manufacturer shall provide two (2) compression spring operators (shocks) enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and closing.
02 The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe welded to the curb assembly.

F. Hardware:
01 Heavy stainless steel pintle hinges shall be provided.
02 Cover shall be equipped with a spring latch with interior and exterior turn handles.
03 Roof hatch shall be equipped with interior and exterior padlock hasps.
04 The latch strike shall be a stamped component bolted to the curb assembly.
05 Cover shall automatically lock in the open position with a rigid hold open arm equipped with a 1” diameter red vinyl grip handle to permit easy release for closing.
06 Compression spring tubes shall be an anti-corrosive composite material and all other hardware shall be zinc plated and chromate sealed.
07 Cover hardware shall be bolted into heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.

G. Ladder Safety Post:
   01 Provide roof hatch with a manufacturer's preassembled ladder safety post. Design is based on The Bilco Co. LadderUP Safety Post, model LU-2.
   02 Performance Characteristics:
      a. Tubular post shall lock automatically when fully extended.
      b. Safety post shall have controlled upward and downward movement.
      c. Release lever shall disengage the post to allow it to be returned to its lowered position.
      d. Post shall have adjustable mounting brackets to fit ladder rung spacing up to 14" (356mm) on center and clamp brackets to accommodate ladder rungs up to 1-3/4" (44mm) in diameter.
   03 Post: Shall be manufactured of high strength square tubing. A pull up loop shall be provided at the upper end of the post to facilitate raising the post.
   04 Material of construction: Factory finish of post Shall be hot-dipped galvanized steel.
   05 Balancing spring: A stainless steel spring balancing mechanism shall be provided to provide smooth, easy, controlled operation when raising and lowering the safety post.
   06 Hardware: All mounting hardware shall be Type 316 stainless steel.
   07 Finishes: Factory finish shall be [insert: yellow powder coat steel.

H. Roof Hatch Rail System:
   01 Provide roof hatch rail system Model RL-S as manufactured by The Bilco Company.
   02 Aluminum rail construction with powder coat paint finish
   03 Posts and rails shall be 1-1/4" schedule 40 pipe in 6061 T6 aluminum alloy.
   04 Curb mounting brackets and teardrop brackets to be 6063 T5 aluminum extrusion.
   05 Locking mechanism to be cast aluminum.
   06 Spring hinges and all fasteners to be type 316 stainless steel.
   07 Color: Safety yellow shall be molded in.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings for compliance with requirements for installation tolerances and other conditions affecting performance.
   01 Coordinate with steel erector and roofing contractor as required.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install products in strict accordance with manufacturer's instructions and approved submittals. Locate units level, plumb, and in proper alignment with adjacent work.
   01 Test units for proper function and adjust until proper operation is achieved.

02 Test fusible link and install replacement fusible link after testing.
03 Repair finishes damaged during installation.
04 Restore finishes so no evidence remains of corrective work.

B. Securely fasten roof hatch to the roof deck with bolts or screws.

C. Hatch rail system shall attached to the cap flashing of the roof hatch and shall not penetrate any roofing material.

3.3 ADJUSTING AND CLEANING

A. Clean exposed surfaces using methods acceptable to the manufacturer which will not damage finish.

B. Provide testing of the heat / smoke vents as required by the local authority having
Jurisdiction. When required, replace fusible links after testing is completed and approved.

END OF SECTION

SECTION 07 81 16

CEMENTITIOUS FIREPROOFING

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide all labor, materials, equipment and services necessary for, and incidental to, the complete and proper installation of all spray-applied fire resistive materials and related work as shown on the Drawings or where specified herein, and in accordance with all applicable requirements of the Contract Documents.
   02 The material and installation shall conform to the applicable building code requirements and the requirements of all authorities having jurisdiction.

C. Related Work:
   01 Section 01 11 23 – Codes
   02 Section 05 12 00 – Structural Steel Framing
   03 Section 05 41 00 – Structural Metal Stud Framing
   04 Section 05 50 00 – Metal Fabrication.
   05 Section 07 84 13 – Penetration Firestopping

1.2 SUBMITTALS

A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. UL Designs: Submit manufacturer's literature indicating applicable U.L. designs to meet required levels of fire resistance and minimum thickness for each steel member size and assemblies shown on the Drawings.

D. Test Data: Independent laboratory test results shall be submitted for all specified performance criteria.

E. Certificate of Non-Contamination: The manufacturer shall submit an affidavit certifying that all materials are 100% asbestos free.

F. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.

G. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

H. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01 Include recommended cleaning products and instructions for use.
   02 Where applicable, provide recommended maintenance schedules and procedures.

I. UL Designs: Submit manufacturer's literature indicating applicable U.L. designs to meet required levels of fire resistance and minimum thickness for each steel member size and assemblies shown on the Drawings.

J. Test Data: Independent laboratory test results shall be submitted for all specified performance criteria

K. Certificate of Non-Contamination: The manufacturer shall submit an affidavit certifying that all materials are 100% asbestos free.

1.3 QUALITY ASSURANCE

A. Work shall be performed by a firm with expertise in the installation of fire protection or similar materials. This firm shall be licensed or otherwise approved by the spray-applied fire resistive material manufacturer.

B. Design and governmental permitting are based on specific U.L. designs correlating to the product(s) specified. Equivalent product(s) from other listed manufacturers, along with their corresponding U.L. designs shall be allowed, provided they do not materially alter the design of the specified or indicated assembly.
   01 If the permitting authority requires revisions to the permit documents due to revised U.L. designs, the Contractor shall be responsible to coordinate and obtain required governmental approvals.

C. Thicknesses of sprayed-on cementitious fireproofing shall be tested by the materials testing lab contracted with the Owner.

1.4 REFERENCES

A. The Work of this Section shall comply with the following:
   01 ASTM E84 - Surface Burning Characteristics of Building Materials.
   02 ASTM E119 - Fire Tests of Building Construction and Materials.
   03 ASTM E605 - Thickness and Density of Sprayed Fire-Resistive Materials Applied to Structural Members.
   04 ASTM E736 - Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members.
   05 ASTM E759 - Effect of Deflection of Sprayed Fire-Resistive Materials Applied to Structural Members.
   06 ASTM E760 - Effect of Impact on the Bonding of Sprayed Fire-Resistive Materials Applied to Structural Members.
   07 ASTM E761 - Compressive Strength of Sprayed Fire-Resistive Materials

Applied to Structural Members.

08 ASTM E859 - Air Erosion of Sprayed Fire-Resistive Materials Applied to Structural Members.

09 ASTM E937 - Corrosion of Steel by Sprayed Fire-Resistive Materials Applied to Structural Members.

10 ASTM E1354 – Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter.

11 ULC/CAN S101- Standard Methods of Fire Tests of Building Construction and Materials.

12 ULC/CAN S102 -Steiner Tunnel Test.

13 ULC/CAN 4 - S114 - Standard Test Method for Determination of Non-combustibility in Building Materials.

14 Underwriters Laboratories, Inc. (UL) Fire Resistance Directory.

15 Underwriters Laboratories of Canada (ULC) List of Equipment and Materials.

16 International Building Code – Houston.

17 AWCI Publication: Standard Practice for the Testing and Inspection of Field Applied Sprayed Fire-Resistive Materials. Technical Manual 12-A; an annotated guide.

B. All materials, application and work shall comply with Table 601, IBC, year / edition having jurisdiction over this project.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the project in manufacturer's unopened packages, fully identified as to trade name, type and other identifying data. Packaging shall bear the UL and ULC labels for fire hazard and fire-resistance classifications.

B. Store materials above ground, in a dry location, protected from weather, moisture and areas of high humidity. Damaged packages found unsuitable for use should be rejected and removed from the project.

1.6 PROJECT CONDITIONS

A. When the prevailing outdoor temperature at the building is less than 40°F (4°C), a minimum substrate and ambient temperature of 40°F (4°C) shall be maintained prior to, during and a minimum of 24 hours after application of the spray-applied fire resistive material. If necessary for job progress, General Contractor shall provide enclosures with heat to maintain temperatures.

B. Provide ventilation to allow proper drying of the spray-applied fire resistive material during and subsequent to its application.

C. Ventilation shall not be less than 4 complete air exchanges per hour until the SFRM is fully cured. When spraying in enclosed areas such as basements, stairwells, shafts and small rooms, additional air exchanges may be necessary.

1.7 SEQUENCING / SCHEDULING

A. The Contractor is responsible for scheduling fireproofing work.

B. The Contractor shall coordinate all trades as required for the installation of work preceding and succeeding fireproofing work as required to maintain the integrity of the fireproofing application and adherence to U.L. design requirements.

C. All fireproofing removed and / or damaged as the result of other work shall be repaired

using the same fireproofing material as required to comply with U.L. designs.

D. Use all necessary means to prevent fireproofing material from being applied to materials not scheduled to receive it. Removal all fireproofing from such materials. In the event of damage, make all necessary repairs and / or replacements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS / MATERIALS

B. Isolatek International:
- 01 Standard Density: CAFCO 300.
- 02 Medium Density: CAFCO 400.

C. GCP Applied Technologies (formerly W. R. Grace Construction Products):
- 01 Standard Density: Monokote MK-6.
- 02 Medium Density: Monokote Z-106HY.

D. Carboline, Southwest Fireproofing:
- 01 Standard Density: Type 5 GP.
- 02 Medium Density: Type 7 GP.

E. The manufacturer providing the fire-proofing material must submit applicable UL designs specific to their product(s).

2.2 MATERIALS

A. Materials shall be applied to conform to the Drawings, Specifications and following minimum test criteria:

01	Flame Spread:	ASTM E84	0
02	Smoke Developed:	ASTM E84	0
03	Density	E605	15 PCF (SD) / 22 PCF (MD)
04	Cohesion / Adhesion	E736	150 PSF (SD) / 430 PSF (MD)
05	Deflection	E759	No Cracks or Delamination
06	Bond Contact	E760	No Cracks or Delamination
07	Compressive Strength	E761	2,800 PSF (SD) / 10,000 PSF (MD)
08	Corrosion Resistance	E937	Does not promote corrosion
09	Combustibility	E1354	Noncombustible

10 The material shall have been tested and reported by Underwriters Laboratories, Inc. (UL) or Underwriters Laboratories of Canada (ULC) in accordance with the procedures of UL 263 (ASTM E119) or CAN4-S101.

B. Standard Density materials may be applied generally at concealed locations as follows:
- 01 Encapsulated in masonry or gyp board assemblies.
- 02 In plenums between ceiling and structure / deck above.
- 03 Other locations not subject to exposure to room occupants.

C. Medium Density materials shall be applied at all rooms / areas / materials exposed to room occupants and other locations as follows:
- 01 Rooms or areas exposed to structure above.
- 02 Rooms or areas with partial ceilings.
- 03 Steel members at the building perimeter walls.
- 04 Materials / areas that may be exposed to weather prior to cover-up.

D. Potable water shall be used for the application of spray-applied fire resistive materials.

E. Spray-applied fire resistive materials shall be free of all forms of asbestos, including actinolite, amosite, anthophyllite, chrysotile, crocidolite and tremolite. Material manufacturer shall submit certification of such.

PART 3 - EXECUTION

3.1 U.L. DESIGNS AND LOCATIONS

A. Definitions:
   01 Structural Frame: all columns and the girders, beams, trusses and spandrels having direct attachment to the column, and bracing members designed to carry gravity loads.
   02 Secondary Members: all members directly supporting floor or roof decks / panels which have no connection to the columns.

B. Provide required thickness and application of sprayed fireproofing at the following locations based on the UL designs listed.

01	Structural Frame:		
02	Floor / ceiling assemblies:	UL G705 & G256	two hour
03	Roof / ceiling assemblies:	UL P922 & P251	one hour
04	Structural tube and pipe columns:	UL X790	one & two hour
05	Wide flange columns:	UL X790	one & two hour

C. Fireproofing is not required at the following locations unless specifically noted:
   01 Exterior canopies.
   02 Roof structure that is 20'-0" or greater above finish floor immediately below assembly; exclusive of columns which shall be fireproofed full height.
   03 Where a partial raised floor encroaches in the 20'-0" clearance, the entire structural bay(s) above the partial raised floor shall be fireproofed.

D. Alternate, manufacturer-specific product tested UL designs shall be acceptable provided they comply with the provisions of this Section and are equivalent designs to those specified.

3.2 PREPARATION

A. All surfaces to receive fire protection shall be free of oil, grease, loose mill scale, dirt, paints/primers (other than those listed and tested) or other foreign materials, which would impair satisfactory bonding to the surface.
   01 Manufacturer shall be contacted for procedures on handling primed/painted steel.

B. Clips, hangers, supports, sleeves and other attachments to the substrate are to be placed by others trades prior to the application of spray-applied fire resistive materials. Coordinate all trades as required.

C. The installation of ducts, piping, conduit or other suspended equipment shall not take place until the application of sprayed fire protection is completely cured in an area.

D. The spray-applied fire resistive material shall only be applied to steel deck which has been fabricated and erected in accordance with the criteria set forth by the Steel Deck

Institute.

E. When roof traffic is anticipated, as in the case of periodic maintenance, roofing pavers shall be installed as a walkway to distribute loads.

3.3 APPLICATION

A. Equipment, mixing and application shall be in accordance with the manufacturer's written application instructions.

B. The application of spray-applied fire resistive material shall not commence until certification has been received by the General Contractor that surfaces to receive sprayed fire protection have been inspected by the applicator and are acceptable to receive sprayed fire protection.

C. All unsuitable substrates must be identified and made known to the General Contractor and corrected prior to the application of the spray-applied fire resistive material.

D. Fire protection shall not be applied to steel floor decks prior to the completion of concrete work on that deck.

E. The application of spray-applied fire resistive material to the underside of roof deck shall not commence until the roof is completely installed and tight, all penthouses are complete, all mechanical units have been placed, and construction roof traffic has ceased.

F. Proper temperature and ventilation shall be maintained as specified in Paragraph 1.6 above.

G. Provide masking, drop cloths or other suitable coverings to prevent overspray from coming in contact with surfaces not intended to be sprayed.

H. Bonding materials (adhesives, catch coats, metal lath, mesh, stud pins, etc.) shall be applied as per the appropriate UL/ULC fire resistance design and manufacturer's written recommendations. A letter from the mesh manufacturer is required for proof of non-combustible materials.

I. Topcoat material, if any, shall be the type recommended and approved by the manufacturer of each spray-applied fire resistive material required for the applications indicated.

3.4 REPAIRING AND CLEANING

A. Provide follow-up application to patch and / or repair fireproofing that has been damaged by other trades. Required thicknesses apply after all interfacing work is complete.

B. After the completion of the Work in this Section, equipment shall be removed and all surfaces not to be sprayed shall be cleaned to the extent to allow proper installation of subsequent work as approved by the Architect.

3.5 INSPECTION AND TESTING

A. The spray-applied fire resistive material shall be tested for thickness and density in

accordance with one of the following procedures:

01 ASTM E605 - Standard Test Method for Thickness and Density of Sprayed Fire-Resistive Materials Applied to Structural Members.

02 AWCI - Inspection Procedure for Field-Applied Sprayed Fire-Resistive Materials, Technical Manual 12-A; an annotated guide.

END OF SECTION

SECTION 07 84 13

PENETRATION FIRESTOPPING

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Furnish all materials and labor required for installation of firestops around through - penetrations of pipe, duct, cable, cable tray, conduit, other electrical devices, blank openings and at the periphery of fire-rated walls, floors, partitions and floor/ceiling assemblies.

C. Related Work:
   01 Section 03 30 00 – Cast-In-Place Concrete
   02 Section 04 20 00 – Unit Masonry
   03 Section 07 92 00 – Joint Sealants
   04 Section 09 21 13 – Plaster Assemblies
   05 Section 09 21 16 – Gypsum Board Assemblies
   06 Division 22 – Plumbing
   07 Division 23 – Heating, Ventilating and Air-Conditioning
   08 Division 26 – Electrical

1.2 SUBMITTALS

A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Submit a copy of UL illustration of each proposed system indicating manufacturer approved modifications.

D. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies. Show details of field applications for all various conditions.

E. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

F. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.

01 Include recommended cleaning products and instructions for use.
02 Where applicable, provide recommended maintenance schedules and procedures.

1.3 QUALITY ASSURANCE

A. Standards:
01 ASTM E814, Standard Method for Fire Tests of Through - Penetration Fire Stops.
02 ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
03 UL 1479, Fire Tests of Through-Penetrations Firestops.
04 UL 723, Standard for Test for Surface Burning Characteristics of Building Materials.
05 UL Fire Resistance Directory; Through - Penetration Firestop Systems (XHEZ), and Fill, Void or Cavity Materials (XHHW).
06 NFPA 101 - Life Safety Code.
07 NFPA 70 - National Electric Code.

B. Performance:
01 Firestop systems shall provide a fire resistance rating at least equal to the hourly resistance rating of the fire-rated barrier.
02 Firestop Systems shall have been tested in accordance with ASTM E814 or UL 1479 under a minimum positive pressure of 0.01 in. of water.

1.4 DEFINITIONS

A. Penetration: Any opening of foreign material passing through or into a fire-rated barrier.

B. Fire-Rated: Have the ability to withstand the effects of a standard fire exposure for a specified time period, as determined by qualified testing.

C. Fire-Rated Barrier: A floor, wall, partition or floor-ceiling assembly able to withstand a standard fire and hose stream test without failure.

D. Fire Resistance Rating: The ability of a structure to act as a barrier to the spread of fire and to confine it to the area of origin. Ratings are expressed in hours and apply to beams, columns, floors, roofs, walls and partitions.

E. Firestopping: A means of sealing openings in fire-rated barriers to preserve or restore the fire resistance rating.

F. Firestop System: A material, or combination of materials, installed to retain the integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke or gases through penetrations in fire-rated vertical barriers It should be used in specific locations as follows:
01 Penetrations for the passage of duct, cable, cable tray, conduit, piping and electrical bus-ways and raceways through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor slabs and floor/ceiling assemblies), and vertical service shafts.
02 Openings between floor slabs and curtain walls.
03 Openings between structurally separate sections of walls of floors.
04 Gaps between the top of walls and ceiling or roof assemblies.
05 Vertical service shafts at each floor level.
06 Expansion joints in walls and floors.

07 Openings and penetrations in fire-rated partitions or walls containing fire doors.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, grade, and UL label where applicable.

B. Coordinate delivery with scheduled installation date to allow minimum storage time at site.

C. Store materials in clean, dry, ventilated location. Protect from soiling, abuse, and moisture. Follow manufacturer's instructions.

1.6 PROJECT CONDITIONS

A. Existing Conditions:
   01 Verify existing conditions and substrates before starting Work. Correct unsatisfactory conditions before proceeding.
   02 Proceed with installation only after penetrations of the substrate and supporting brackets have been installed.

B. Environmental Requirements:
   01 Furnish adequate ventilation if using solvent.
   02 Furnish forced air ventilation during installation if required by manufacturer.
   03 Keep flammable materials away from sparks or flame.
   04 Provide masking and drop cloths to prevent contamination of adjacent surfaces by fire stopping materials.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Design of penetration firestopping sealants is based on products manufactured by Hilti Construction Chemicals, Inc.

B. Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this Section, provided proposed products meet or exceed all specified requirements.
   01 3M Corporations
   02 Rectoseal
   03 Tremco

2.2 MATERIALS

A. Firestopping materials / constructions shall constitute one or more of the following products or equal by other listed manufacturers.
   01 Hilti CFS-S SIL GG Firestop Sealant: An adhesive, one-part, silicone-based, elastomeric sealant.
   02 Hilti FS ONE Intumescent Wrap: An Aluminum foil-backed intumescent strip for plastic or insulate pipe.
   03 Hilti CP 620 Filling and Sealing Foam or fire-tested designs.

B. Firestopping materials shall be asbestos-free, emit no toxic or combustible fumes and be capable of maintaining an effective barrier against flame, smoke, gas, and water in compliance with previously referenced standards.

C. Firestopping materials /systems shall be flexible to allow for normal movement of building structure and penetrating item(s) without affecting the adhesion or integrity of the system.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrate surfaces to ensure proper and adequate structural support for the specified UL Rated Firestop System. Install fire-rated partitions /floors with void to receive firestop system.

B. Clean surfaces from all foreign materials i.e., loose debris, dirt, oil, grease, wax and/or oil caulking before sealant is applied.

C. Field measure and verify dimensions as required.

D. Protect adjacent areas or surfaces from damage as a result of the work of this Section.

3.2 APPLICATION

A. Installation of fire stopping materials shall be in exact accordance with the manufacturer's latest published instructions.

B. Installation shall be in accordance with the appropriate UL Building Materials Directory Assembly or with the appropriate Warnock Hersey International Listing.

C. Seal holes or voids made by penetrating items to ensure an effective fire and smoke barrier.

D. Seal all intersections and all penetrations of floors, ceilings, walls, and columns.

E. Seal around all cutouts for lights, cabinets pipes, and plumbing, HVAC ducts, electrical boxes, etc.

3.3 FIELD QUALITY CONTROL

A. Examine finished penetrations to ensure proper installation before concealing or enclosing any areas of work.

B. Keep areas of work accessible until inspection by applicable code authorities, and Architect.

C. Manufacturer's Field Service: Inspect to verify and confirm that systems installation is in strict conformance with manufacturer's and UL requirements. Report to Architect.

D. Correct unacceptable work and provide further inspection to verify compliance with requirements.

3.4 CLEANING

A. Immediately remove all spots, smears, stains, residues, adhesives, etc., from the Work of this Section and or upon adjacent areas or surfaces which result from the Work of this Section.

B. Upon the completion of the Work of this Section, dispose of (away from site) all debris, trash containers, residue, remnants and scraps which result from the Work of this Section.

C. Cleaning to be free of volatile solvents. Leave work area in a clean and satisfactory condition.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 This Section includes exterior building and site work sealants.
   02 Sealants for moving joints.
   03 Interior caulking.
   04 Provide foam backer rods where shown or required for proper installation of sealants.

C. Related Work:
   01 Section 08 80 00 – Glazing.
   02 Section 32 13 13 – Concrete Paving.

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
   01 If products from an acceptable manufacturer are being submitted, specifically cross reference the proposed products to the listed as the basis of design products.

C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show details of field fabrications, connections and details.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01 Include recommended cleaning products and instructions for use.

02 Where applicable, provide recommended maintenance schedules and procedures.

F. Color / Finish Samples:
01 Provide two (2) samples of each finish for selection by the Architect.
02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
03 Provide custom color to match color(s) of adjacent surface(s).

G. On-site sample for Architect's approval of colors.

H. For warranties longer than one (1) year, submit a sample of the warranty proposed to be furnished.

1.3 REFERENCES

A. ASTM International
01 ASTM C 510 - Standard Test Method for Staining and Color Change of Single- or Multicomponent Joint Sealants.
02 ASTM C 661 - Standard Test Method for Indentation Hardness of Elastomeric Type Sealants by Means of a Durometer.
03 ASTM C 719 - Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle).
04 ASTM C 794 - Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants.
05 ASTM C 834 - Specification for Latex Sealants.
06 ASTM C 920 - Specification for Elastomeric Joint Sealants.
07 ASTM C 1087 - Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems.
08 ASTM C 1193 - Guide for Use of Joint Sealants.
09 ASTM C 1247 - Standard Test Method for Durability of Sealants Exposed to Continuous Immersion in Liquids.
10 ASTM C 1248 - Test Method for Staining of Porous Substrate by Joint Sealants.
11 ASTM C 1311 - Specification for Solvent Release Sealants.
12 ASTM C 1330 - Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
13 ASTM D 412 - Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension.
14 ASTM D 624 - Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
15 ASTM D 2203 - Standard Test Method for Staining from Sealants.
16 ASTM D 2240 - Test Method for Rubber Property - Durometer Hardness.

B. NSF International:
01 NSF Standard 51 – Food Equipment Materials.

C. U.S. Food and Drug Administration (FDA):
01 21 CFR 177.2600 - Title 21 Part 177 Indirect Food Additives: Polymers

1.4 WARRANTY

A. Warrant the work specified herein for two (2) years against becoming unserviceable or causing an objectionable appearance, resulting from either defective or nonconforming materials or workmanship.

B. Warrant exterior joints against failure of the joint to effectively seal out water or moisture. Warrant interior joints against cracking, crazing separation of the material from the substrate or other joint failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Design is based on products manufactured by BASF MasterSeal.

2.2 MATERIALS

A. Caulking for exposed non-working interior locations at all hollow metal frames and abutting surfaces at ceiling, wall angles and all other locations for finished appearance:
01 Type: BASF MasterSeal

B. Exterior concrete horizontal joints, including drives, parking, sidewalks, play surfaces and other flatwork:
01 Type: MasterSeal SL2 Slope Grade
02 Note: Refer to 32 13 13 for sealant at building to flatwork.

C. Exterior highly active joints in walls, masonry or concrete fences:
01 Type: MasterSeal NP2 (two part component)

D. Exterior joints around windows, glazing, entrances, soffit joints and other general sealant areas:
01 Type: MasterSeal NP1 (one part component)

E. Exterior joints of concrete tilt-wall panels.
01 Type: MasterSeal NP2 (two part component)

F. Interior Expansion Contraction or Control Joints where movement is to be accommodated:
01 Type: MasterSeal NP1 (one part component)

G. Interior General Purpose:
01 Type: MasterSeal NP1 (one part component)

H. Primers, Cleaners, Top Coats: Use only materials listed as suitable in resistance to staining, compatibility and durability before proceeding. (MasterSeal 733 primer)

I. Back-Up Filler: Closed cell or open cell, non-gassing filler as recommended by sealant manufacturer. (MasterSeal closed cell backer rod)

J. Sealant colors shall be as selected by the Architect from manufacturer's full range of color selections. Expansion and control joint sealant shall match color(s) of masonry it is adjacent to.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine all assemblies to receive sealant and verify all work is complete as required for the proper installation of sealant.

B. Do not accept joints that are wider than joint width limitations of the sealant to be used.

C. Notify Contractor of any irregularities and / or discrepancies and do not proceed until fully resolved.

3.2 APPLICATION

A. Temperatures: Do not install sealants when air temperature is under 40°Fahrenheit. Sealants may be warmed to ease installation when recommended by the manufacturer.

B. Tooling:
   01 Tool exposed joints to a slightly concave surface using slicking materials recommended by the manufacturer.
   02 The tooling procedure shall press sealant against the sides of the groove.
   03 No materials shall be left "feathered" out or smeared on the abutting materials.
   04 If necessary, protect adjacent surfaces with tape.
   05 Completed joints shall have a uniform professional appearance.
   06 Use an anti-tack compound on sealant that does not set up fast enough to avoid dust collection.

C. Sealant Back-Up: Provide a back-up filler where groove depth is too great to fill with sealant. Review joint design with Architect.

D. Compressive Filler: Seal vertical expansion joints with fillers. Provide compressible filler twice the width of the joint and with a depth of one and one-half times the compressed width. Lap ends a minimum of 2 inches.

E. Seal ends together in such a manner to allow natural drainage.
   01 Install filler by compressing material and sliding into joint.
   02 Align filler on one face of the joint before it expands to the full joint width.

F. All wall penetrations shall be sealed. Use appropriate sealant at fire-rated wall assembles.

3.3 CLEAN-UP

A. Immediately following installation of sealants, remove all excess sealant as required to result in clean sealant lines and applications.

B. Protect sealant installations as required until sealant has reached final set.

END OF SECTION

SECTION 07 95 00

EXPANSION JOINT COVERS

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work: Provide expansion joint covers as indicated on the Drawings, including, but limited to:
   01 Floor to floor conditions
   02 Floor to wall conditions
   03 Interior wall to wall conditions
   04 Exterior wall to wall conditions.

C. Related Work:
   01 Section 05 50 00 – Metal Fabrications
   02 Section 07 52 00 – Modified Bituminous Membrane Roofing
   03 Section 07 62 00 – Steel Metal Flashing
   04 Section 09 21 16 – Gypsum Board Assemblies

1.2 SUBMITTALS

A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies in actual conditions within the Work of this Project.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01 Include recommended cleaning products and instructions for use.
   02 Where applicable, provide recommended maintenance schedules and procedures.

F. Color / Finish Samples:
   01 Provide two (2) samples of each finish for selection by the Architect.
   02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
   03 Minimum size shall be 6” in length, but must be large enough to convey attributes of the proposed product.
   04 Provide sample of the proposed assembly(s); 6” minimum length.

G. For warranties longer than one (1) year, submit a sample of the warranty proposed to be furnished.

1.3 REFERENCES

A. ASTM International (ASTM):
   01 ASTM A240 / A240-M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
   02 ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   03 ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   04 ASTM C510 – Standard Test Method for Staining and Color Change of Single- or Multicomponent Joint Sealants
   05 ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer
   06 ASTM D2240 - Standard Test Method for Rubber Property—Durometer Hardness.
   07 ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
   08 ASTM E1399 - Standard Test Method for Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems.

B. American Architectural Manufacturers Association (AAMA):
   01 AAMA 611, Class II Anodic Aluminum Finishes

C. National Association of Architectural Metal Manufacturers (NAAMM):
   01 Metal Finishes Manual for Architectural and Metal Products.

1.4 WARRANTY

A. All expansion joint covers shall be covered by manufacturer’s five (5) year warranty against manufacturer’s defects and becoming unserviceable for the intended purpose.

PART 2 - PRODUCTS

2.1 INTERIOR EXPANSION JOINT COVERS

A. Design of interior expansion joint covers is based on products manufactured by C-S Group.

B. Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this Section, provide all proposed products meet or exceed the specified requirements.

01 Emseal
02 Inpro Corporation
03 Nystrom

C. General Materials:
01 Aluminum: ASTM B 221, Alloy 6063-T5, 6063-T6, 6063-T52, 6061-T5, 6061-T6, 6061-T51, 6105-T5, 6105-T6, 6005-T5, 6005A-T5, 6005A-T61 for extrusions; ASTM B 209, Alloy 6061-T6, 3003-H14, 5005-H34 for sheet and plate.
02 Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.
03 Clear Anodized Finish: Class II, Clear Anodic Finish: AA-M12C22A31 complying with AAMA 611.
04 Bronze Anodized Finish: Class II, Color Anodic Finish: AA-M12C22A32/A34 (complying with AAMA 611.
05 Stainless Steel Finish: ASTM A240A / A240M - Type 304 for plates, sheet, and strips.
a. Finish: No.4, directional satin.
b. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches.
c. Run grain with long dimension of each piece.
06 Elastomeric Seals: Preformed elastomeric membranes or extrusions to be installed in metal frames.
07 Compression Seals: ASTM D2000; preformed rectangular elastomeric extrusions having internal baffle system and designed to function under compression.
08 Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to meet performance criteria for required rating period.
a. Provide at expansion joint covers at 2nd floor assemblies as required to maintain specified fire rating.
b. Provide at expansion joint covers at rated partition assemblies as required to maintain specified fire rating.

D. General: Provide architectural joint systems of design, basic profile, materials, and operation indicated.
01 While specified joint systems establish the function and aesthetic intent, it may be necessary for the manufacturer to modify the joint systems to accommodate the movement requirements as scheduled in the contract documents.
02 Such modifications should be made without significant changes to the aesthetic or functional intent of the joint systems.
03 Provide units with capability to accommodate variations in adjacent surfaces.

E. Design architectural joint systems for the following size and movement characteristics:
01 Nominal Joint Width: 1”
02 Maximum Joint Width: 1-1/4”
03 Minimum Joint Width: 3/4".

F. Floor-To-Floor Expansion Joint Covers: Design is based on C-S Group model GFST series.
01 Aluminum Extrusions: Type as recommended by the manufacturer, in compliance with ASTM B221.
02 Primary Seal: Dual durometer TPR gasket, 65 shore A, 90 Shore A, ASTM D2240.
03 Gasket color as selected by the Architect from manufacturer’s full range of selections.

G. Floor-To-Wall Expansion Joint Covers; Design is based on C-S Group model GFSTW series.
   01 Same properties as floor-to-floor expansion joint cover.

H. Wall-To-Wall Expansion Joint Covers: Design is based on C-S Group model FWF series.
   01 Aluminum Extrusions: Type as recommended by the manufacturer, in compliance with ASTM B221.
   02 Primary Seal: Dual durometer TPR gasket, 65 shore A, 90 Shore A, ASTM D2240.
   03 Gasket color as selected by the Architect from manufacturer's full range of selections.

I. Gypsum Board Ceiling-To-Ceiling Expansion Joint Cover: Design is based on C-S Group model FWF series.

J. Above expansion joint covers installed in rated assemblies shall be the same model number with addition of manufacturer's materials required for a 1-hour or 2-hour fire rated assembly as indicated on the Drawings.

2.2 EXTERIOR EXPANSION JOINT COVERS

A. Design of exterior expansion joint covers is based on products manufactured by C-S Group.

B. Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this Section, provide all proposed products meet or exceed the specified requirements.
   01 Emseal
   02 Inpro Corporation
   03 Nystrom
   04 Tremco

C. Vertical Wall-To-Wall Expansion Joints at Masonry Veneer: Design is based on C-S Group model VF series.
   01 A precompressed low-modulus silicone with an open-cell polyurethane foam infused with a water-based, non-drying acrylic dispersion.
   02 Color as selected by the Architect from manufacturer's full range of color selections, minimum 12.
   03 Durometer Hardness: ASTM C661, Shore AI, Silicone coating – not to exceed 15 pts (+/-5).
   04 Weatherometer: ASTM C510, Xenon Arc Weatherometer 2000 hours – no visible deterioration.
   05 Wind Loading: ASTM E330, 150 MPH wind equivalent, +/- 0.1 mm net deflection
   06 Water Penetration: ASTM E331-00, No water penetration after consecutive 15-minute soak durations under pressures of: 500 ΔP(Pa), 65 mph equivalent wind driven rain; 1000 ΔP(Pa), 92 mph equivalent wind driven rain; 5000 ΔP(Pa), 205 mph equivalent wind driven rain.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate all trades as required for proper design, sizing and locations of interfacing work to accommodate expansion joint covers.
   01 Verify flooring type to be installed at floor-to-floor expansion joint covers; and shim as required to match flooring height within 1/16”.
   02 Coordinate with drywall trades as required to properly float drywall at wall-to-wall expansion joint covers.
   03 Coordinate with masonry trades as required to provide flush struck end joints at masonry to interface with exterior wall-to-wall expansion joint covers

B. Examine surfaces and interfacing Work where architectural joint systems will be installed for installation tolerances and other conditions affecting performance of Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Prepare substrates according to architectural joint system manufacturer's written instructions.

3.2 INSTALLATION

A. Install all expansion joint covers in strict accordance with manufacturer's printed instructions and final reviewed Shop Drawings.

B. Coordinate and furnish anchorages, Setting Drawings, and instructions for installing joint systems. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of joint systems.

END OF SECTION

SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide all interior and exterior hollow metal frames, including interior glazed opening frames, where indicated or scheduled on the Drawings.
   02 Provide all interior and exterior hollow metal doors where indicated or scheduled on the Drawings.

C. Related Work:
   01 Section 01 22 00 – Unit Prices
   02 Section 04 20 00 – Unit Masonry
   03 Section 07 92 00 – Joint Sealants
   04 Section 08 14 23.16 – Plastic-Laminate-Faced Wood Doors
   05 Section 08 71 00 – Door Hardware
   06 Section 08 80 00 – Glazing
   07 Section 09 21 16 – Gypsum Board Assemblies

1.2 SUBMITTALS

A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
   01 Show or schedule location, size, thickness, elevation, details of construction, location and extent of hardware blocking, fire rating and other pertinent data for each door required.

C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.

D. If project is within a TWIA wind zone, provide documentation demonstrating compliance and inclusion in TDI approved door and frame assemblies.
   01 For all exterior hollow metal framing, provide documentation in the form of a Texas Engineer signed and sealed certification that proposed door and frame assembly, including proposed anchoring and hardware, meets or exceeds specified wind loads.

E. Finish Hardware Location: Hollow metal manufacturer shall obtain an approved

hardware schedule, hardware templates and samples of physical hardware where necessary to ensure correct fitting and installation.

F. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

G. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01 Include recommended cleaning products and instructions for use.
   02 Where applicable, provide recommended maintenance schedules and procedures.

1.3 REFERENCES

A. ASTM International (ASTM):
   01 A240/A240M-15b - Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
   02 ASTM A366 - Steel, carbon, cold-rolled sheet, commercial quality.
   03 ASTM A526 - Steel sheet, zinc-coated (galvanized) by hot dip process, commercial quality.
   04 A653/A653M-15 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip.
   05 A1008/A1008M-15 - Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength Low Alloy and High Strength Low Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
   06 B209-14 - Aluminum and Aluminum-Alloy Sheet and Plate.
   07 B209M-14 - Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
   08 B221-14 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   09 B221M-13 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
   10 D3656/D3656M-13 - Insect Screening and Louver Cloth Woven from Vinyl Coated Glass Yarns.
   11 E90-09 - Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

B. National Association of Architectural Metal Manufacturers (NAAMM), AMP 500-06 - Metal Finishes Manual.

C. National Fire Protection Association (NFPA), NFPA 80-16 - Fire Doors and Other Opening Protectives.

D. UL LLC (UL):
   01 10C-09 - Positive Pressure Fire Tests of Door Assemblies.
   02 1784-15 - Air Leakage Tests of Door Assemblies and Other Opening Protectives.

E. American National Standards Institute:
   01 ANSI A151-1-1969, Test Method for Standard Steel Doors.
   02 ANSI A250.11-2001 Recommended Erection Instructions for Steel Frames.

1.4 DELIVERY AND HANDLING

B. Deliver, store and handle hollow metal work in strict accordance with manufacture's recommendations to prevent damage, rust and deterioration.

C. Store materials in a covered, dry location and promptly clean and touch-up scratches or rust spots with a rust-inhibitive primer.

D. Doors shall have their wrappings or coverings removed upon delivery at the building site and shall be stored in a vertical position spaced by locking for air circulation.

E. Doors and frames shall be clearly identified with opening number as indicated on the Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Hollow metal door and frame manufacturers shall be members of the National Association of Architectural Metal Manufacturers (NAAMM).

B. The following manufacturers are acceptable to provide hollow metal doors and frames subject to meeting all provisions and requirements of this Section of Specifications:
   01 American Door Products
   02 Ceco / United Dominion Industries
   03 Curries
   04 Door Pro Systems
   05 Pearland Industries
   06 Republic Doors and Frames
   07 Steelcraft

2.2 MATERIALS

A. Doors:
   01 Doors shall be custom made, of types and sizes shown on reviewed Shop Drawings, and shall be fully welded seamless construction with no visible seams or joints on faces or vertical edges.
   02 Minimum door thickness shall be 1 3/4 inches, unless specifically noted or shown differently.
   03 Doors shall be strong, rigid and neat in appearance, free from warp and buckle. Corner bends shall be true and straight and of minimum radius for gauge of metal used.
   04 Provide 22-gauge steel stiffeners spaced max. 6-inch O.C. and extending full height of door.
   05 Fill interior with foamed in place urethane. Use mineral filler as required for labeled doors.
   06 Door Face Gauges:
      a. Doors 36" wide or less shall be 16 gauge galvanized.
      b. Doors 37" wide or more shall be 14 gauge galvanized.
   07 Faces shall be joined at vertical edges of door by a continuous weld extending full height of door. Welds shall be ground, filled and dressed smooth to provide a smooth flush surface.
   08 Top and bottom edges of doors shall be closed with a continuous recessed steel channel not less than 16 gauge, extending full width of door and spot welded to both faces.
      a. Exterior doors shall have an additional flush closing channel at top and

bottom edges.

b. Openings shall be provided in the bottom closure channel at top and bottom edges.

c. Openings shall be provided in the bottom closure of exterior doors to permit the escape of entrapped moisture.

09 Edge profile shall be provided on both vertical edges of door as follows:

a. Single-acting swing doors - beveled 1/8 inch in 2-inch.

10 Hardware Reinforcements:

a. Doors shall be mortised, reinforced, drilled and tapped at factory for fully templated hardware, in accord with the reviewed hardware schedule and template provided by Section 08 71 00 - Door Hardware. Where surface-mounted hardware is to be applied, doors shall have reinforcing plates only.

b. Minimum gauges for hardware reinforcing plates shall be as follows:

1. Hinge & pivot reinforcements: 7 gauge.
2. Reinforcements for lock face, flush bolts, concealed holders, concealed or surface-mounted closers: 12 gauge.
3. Reinforcements for lock face, flush bolts, concealed holders, concealed or surface-mounted closers: 12 gauge.
4. Channel / U-reinforcing at door lights shall be minimum 20 gauge; continuous all sides.

11 Edge Clearances:

a. Between door and frame at head and jambs: 1/8 inch.

b. At door sills with no threshold, 5/8 to 3/4 inch above finished floor.

c. At door sills with threshold, as required to suit threshold.

d. Between meeting edges of double doors - 1/8 inch.

12 Door Lite Kits:

a. Design is based on National Guard Products, low-profile lite kit; L-FRA 100 or approved equal.

b. Material: 18 gauge, cold-rolled steel with powder-coated finish.

c. Color: To be selected by architect from full range of standard and optional colors (to include, but not be limited to, metallic and black options).

d. Standard lite kit opening to measure 6 inches by 27 inches.

e. Provide silicone acoustic seal at locations where acoustic glass is being used.

Provide rated lite kit at locations where rated glass is indicated. Kit to match rating of door.

13 Door Louvers: Fabricate from minimum 20 gauge and galvannealed material; inverted “Y” blade, sight-proof type, unless otherwise shown. Louver frame shall be wrap-around type secured with vandal-proof fasteners.

B. Frames:

01 Frames for exterior openings shall be made of commercial cold rolled steel conforming to ASTM A366, and shall be galvanized after fabrication.

02 Frames for interior openings shall be a) commercial grade, cold-rolled steel conforming to ASTM A366 or b) commercial grade hot rolled and pickled steel conforming to ASTM A569.

03 Door Frame Gauges:

a. Exterior opening frames 48” wide or less shall be 14 gauge.

b. Exterior opening frames 49” wide or more shall be 12 gauge.

c. Interior opening frames 48” wide or less shall be 16 gauge.

d. Interior opening frames 49” wide or more shall be 14 gauge.

04 Window Frame Gauges:

a. Interior opening frames with jamb / vertical mullions width / spacing 72” wide or less, and 30 SF or less shall be 16 gauge.

b. Interior opening frames with jamb / vertical mullions width / spacing 73” wide or more, and greater than 30 SF shall be 14 gauge.

05 Frames shall be custom made, welded units with integral trim of sizes and shapes shown on Drawings and required for the specific intended use.
   a. Door stops shall be nominal 5/8”.
   b. Returns shall be 1/2".

06 Frames shall be strong and rigid, neat in appearance, square, true and free of defects, warp and buckle. Molded members shall be clean cut, straight and of uniform profile throughout their length.

07 Jamb depths and profile shall be as shown on Drawings and required for the specific intended use.

08 Corner joints shall have contact edges closed tight, with trim faces mitered and continuously welded, and stops butted. The use of gussets shall not be permitted.

09 Minimum depth of stops shall be 5/8 inch.

10 Frames for multiple openings shall have mullion and rail members which are closed tubular shapes having no visible seams or joints. Joints between faces of abutting members shall be securely welded and finished smooth.

11 Hardware Reinforcements: Frames shall be mortised, reinforced, drilled and tapped at factory for fully templated hardware in accordance with finish hardware schedule and templates provided by Section 08 71 00 - Door Hardware. Where surface-mounted hardware is to be applied, frames shall have reinforcing plates only.

12 Minimum thickness of hardware reinforcing plates shall be as follows:
   a. Hinge and pivot reinforcements (1-1/4" x 10" minimum size): 7 gauge.
   b. Strike reinforcements: 12 gauge.
   c. Flush bolt reinforcements: 12 gauge.
   d. Closer reinforcements: 12 gauge.
   e. Reinforcements for surface-mounted hardware, hold-open arms, surface panic devices: 12 gauge.

13 Floor anchors shall be securely welded inside each jamb, with holes for floor anchorage.

14 Jamb Anchors for frames for installation in masonry walls shall be provided with adjustable jamb anchors of the T-Strap type. Anchors shall be not less than 16-gauge steel. The number of anchors provided at each jamb shall be as follows:
   a. Frames up to 7'-6" height - 3 anchors.
   b. Frames 7'-6" to 8'-0" height - 4 anchors.
   c. Frames over 8'-0" height - 1 anchor for each 2 feet, or fraction thereof in height.

15 Jamb Anchors for frames for installation in wood or metal stud partitions shall be provided with steel anchors of suitable approved design, not less than 16-gauge thickness, securely welded inside each jamb as follows:
   a. Frames up to 7'-6" height - 4 anchors.
   b. Frames 7'-6" to 8'-0" height - 5 anchors.
   c. Frames over 8'-0" height - Four anchors plus one additional for each 2 feet, or fraction thereof over 8’-0”.

16 Jamb Anchors for frames to be anchored to previously placed concrete, masonry or structural steel shall be provided with anchors of suitable design as shown on reviewed shop drawings.

17 Dust cover boxes of not less than 26-gauge steel shall be provided at all mortised hardware items.

18 Frames shall be provided with steel spreader temporarily attached to bottoms of both jambs for bracing during shipping and handling.

19 Glass stops for interior glazed frames shall be loose stops, not less than 18-gauge steel, 1/2" x 1/2", with butt corner joints, secured to frame opening by countersunk tamper proof screws. Snap-on attachments will not be acceptable.

20 Prepare frame for silencers. Provide three single silencers for single doors on strike side. Provide two single silencers on frame head at double doors without mullions.

C. Finish: Shop paint steel (whether galvanized or ungalvanized) stops and accessories as follows:
01 Clean surfaces free of mill scale, rust, oil, grease, dirt and other foreign matter.
02 Chemically treat surfaces and apply one coat of an approved baked-on rust-inhibitive primer paint to provide a minimum 0.5 mil dry film thickness.
03 Frames at exterior openings shall be coated on the inside of the frame with a commercial grade, water-based mastic compound (or other approved coating material) prior to installation; 20 mil minimum coating / coverage.

D. Labeled Doors and Frames:
01 Labeled doors and frames shall be provided for openings requiring fire protection ratings as scheduled. Such doors and frames shall be constructed as tested and approved by Underwriters Laboratories or other nationally recognized testing agency having a factory inspection service.
02 If any door or frame scheduled to be fire rated cannot qualify for appropriate labeling because of its size, design, hardware or other reason; the Architect shall be so advised before fabrication work on that item is started.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Separate dissimilar metals, protect against galvanic action.

B. Frames:
01 Anchorage and Connections: Firmly anchor and secure to adjacent construction in strict accordance with manufacturer's Shop Drawings and installation instructions.
02 Frame Spreader Bars: Leave intact until frames are set permanently square and plumb and frame anchors are securely attached.
03 Remove hardware, with the exception of prime-coated items, tag box, and reinstall after finish paint work is completed.
04 Installation of labeled frames shall conform to National Fire Protection Association Pamphlet No. 80, "Fire Door and Windows" and UL design requirements.
05 At exterior locations, coat interior of frame with mastic or other approved coating material prior to installation; minimum 20 mil thickness.

C. Doors:
01 Hang doors square, plumb and straight, firmly anchored into position. Eliminate hinge bound conditions and making all items smooth operating. Adjust operable parts for correct functions.
02 Apply hardware in accordance with hardware manufacturer's templates and instructions.
03 Remove hardware, with the exception of prime-coated items, tag box, and reinstall after finish paint work is completed.
04 Installation of labeled doors shall conform to National Fire Protection Association Pamphlet No. 80, "Fire Doors and Windows" and UL design requirements.

D. Coordinate with other trades as required for installation of glass and glazing to be

installed in doors and frames.

E. Immediately after erection, sand smooth all rusted and damaged areas of prime coat and apply touch-up with compatible air-drying primer.

END OF SECTION

SECTION 08 14 23.16

PLASTIC LAMINATE FACED WOOD DOORS

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide solid core, plastic laminate faced, wood doors in sizes and styles as indicated and scheduled on the Drawings.

C. Related Work:
   01 Section 08 11 13 – Hollow Metal Doors and Frames
   02 Section 08 71 00 – Door Hardware
   03 Section 08 80 00 – Glazing
   04 Section 08 87 23 – Safety and Security Films
   05 Section 08 88 13 – Fire Rated Glazing Systems

1.2 SUBMITTALS

A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
   01 Show or schedule location, size, thickness, elevation, details of construction, location and extent of hardware blocking, fire rating and other pertinent data for each door required.

C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of field fabrications, connections and details.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01 Include recommended cleaning products and instructions for use.

02 Where applicable, provide recommended maintenance schedules and procedures.

F. Color / Finish Samples:
01 Provide two (2) samples of each plastic laminate finish for selection by the Architect.
02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
03 Minimum size shall be 3” x 3” but must be large enough to convey attributes of the proposed product.

G. Provide a copy of the lifetime warranty to be issued for contract close-out.

H. For warranties longer than one (1) year, submit a sample of the warranty proposed to be furnished.

1.3 REFERENCES

A. ASTM International:
01 ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
02 ASTM E413 - Classification for Rating Sound Insulation.

B. American National Standards Institute (ANSI), ANSI A208.1 - Particleboard.

C. American Woodworking Institute (AWI), AWI/AWMAC/WI Architectural Woodwork Standards, Section 9 - Doors.

D. Wood Door Manufacturer’s Association (WDMA):
01 WDMA I.S.1-A - Architectural Wood Flush Doors.
02 WDMA I.S. 10 - Industry Standard for Testing Cellulosic Composite Materials for Use in Fenestration Products.

E. National Fire Protection Association (NFPA):
01 NFPA 80 - Standard for Fire Doors and Other Opening Protectives.
02 NFPA 252 - Standard Methods of Testing pf Door Assemblies.

F. Underwriters Laboratories:
01 UL 10-C - Standard for Positive Pressure Fire Tests of Door Assemblies.
02 UL Label Fire Door; All fire rated doors shall bear a UL identification on the hinge stile.

1.4 QUALITY ASSURANCE

A. High pressure decorative laminate faced doors shall conform to the latest edition of the following standards:
01 WDMA I.S. 1-A.
02 AWI Standards and requirements for “Premium Grade”.

B. Tolerances for warp, telegraphing, squareness, and pre-fitting dimensions as per the latest edition of WDMA I.S. 1-A.

C. Identifying Label: Each door shall bear identifying label indicating:
01 Door manufacturer.
02 Order number.

03 Door number.
04 Fire rating, if applicable.

D. Environmental Responsibility: Provide doors manufactured with the following environmentally responsible components:
01 Core: Particle Board; no added urea-formaldehyde.
02 Composite Crossband: High-Density Fiberboard (HDF); no added urea-formaldehyde.
03 Stiles and Rails: Structural Composite Lumber (SCL); no added urea-formaldehyde.

E. Where fire rated doors are required, provide labeled doors. Construction details and hardware application shall be as approved by the labeling agency.

1.5 WARRANTY

A. All doors shall be warranted for the life of the door under normal use against material defects, warping, and delamination of laminate facing and becoming unserviceable.

B. Any defects noted during the warranty period shall be corrected at no cost to the Building Owner. Such corrective work shall include all labor and material for repair, replacement, refinishing and re-hanging as required.

C. Provide Manufacturer’s executed, written lifetime warranty with close-out documentation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Design of Plastic Laminate Faced Doors is based on products manufactured by VT Industries.

B. Acceptable Manufacturers: the following manufacturers are acceptable to provide plastic laminate clad doors provided proposed products meet or exceed all specified requirements:
01 Alfab, Inc.
02 Graham Manufacturing Co.
03 Marlite
04 Marshfield Door Systems
05 Mengel Wood Industries, Inc.
06 Ragland Manufacturing Co.

C. Plastic Laminate: The following manufacturers are acceptable to provide plastic laminate:
01 Ralph Wilson Plastics, "Wilsonart".
02 Formica Corp., "Formica".

2.2 MATERIALS - DOORS

A. Design of solid-core plastic laminate clad doors is based on VT Industries Heritage Collection
01 Non-rate & 20-minute rated doors: Series 303H doors.
02 45-, 60- and 90- minute rated doors: Series FD-5 doors

a. Doors to be fire-resistant to meet the requirements of the International Building Code (IBC), version 2018.

B. All doors shall be 1-3/4" thick unless thicker door is required to achieve fire rating. If thicker door is required, notify architect and coordinate with frame manufacturer.

C. Core Material:
01 Core Material:
a. Particle Board Core for non-rated and 20-minute fire-rated doors. Minimum 28-32 PCF. Comply with particleboard standard ANSI A208.1, Grade 1-LD-2.
b. Fire composite (Proforce) for 45-, 60- and 90-minute rated doors.
02 Crossbands:
a. Composite Crossband for non-rated and 20-minute fire-rated doors.
b. High Density Fiberboard (HDF), 20% of door construction weight, pre-consumer recycled material.

D. Door Stiles:
01 Door Stiles:
a. Non-rated and 20-minute rated doors: minimum 1-3/8" (nominal) Structural Composite Lumber (SCL) bonded to core with minimum 1/16" hardwood veneer suitable for staining or painting to approximate plastic laminate finish as selected by the Architect.
b. 45-, 60-, 90- minute rated doors: Fire composite materials with intumescent.
02 Vertical door edges shall be factory painted / stained to match door face. Factory shall supply matching paint / stain and edges shall be touched-up in field.
03 Plastic laminate stiles shall not be acceptable.

E. Door Rails:
01 Door Rail:
a. Non-rated and 20-minute rated doors: minimum 1-3/8" (nominal) Structural Composite Lumber (SCL).
b. 45-, 60-, 90- minute rated doors: Fire composite materials with surface applied intumescent on the top rail only.
02 Minimum 6" head rail at all doors to receive a closer.
03 Seal top, bottom and cut surface of openings at factory with two coats of varnish.
04 Where head rail may be visible from a second story vantage point, head rail shall be stained or painted to match stiles.
05 Glass Lite Frames / Stops: Metal type with painted finish. Coordinate with other trades as required.

F. Fire Pins:
01 Provide as required to achieve door rating. Quantity and location as recommended by manufacturer.

2.3 MATERIALS – PLASTIC AMINATE

A. Horizontal grade, 0.048" minimum thickness.

B. Finish shall be as selected by the Architect from manufacturer's full range of colors and finishes.

C. Laminate shall be applied to the core by a hot press method using Type 1 exterior grade, water-resistant adhesive.

2.4 DOOR LITE FRAMES

A. Design of door lite framing for glass inserts is based on National Guard Products (NGP) model L-FRA100 Low Profile Lite Kit.
   01 Other manufacturers shall be considered provide proposed products meet or exceed all specified requirements.
   02 Material: 18 gauge, cold-rolled steel with powder-coated finish.
   03 Provide in sizes as indicated on the Drawings.
   04 Color: To be selected by architect from full range of standard and optional colors (to include, but not be limited to, metallic and black options).
   05 Suitable for up to 3/8" glazing.
   06 Standard lite kit opening to measure 6 inches by 27 inches unless shown otherwise on drawings.
   07 Welded construction with mitered corners.
   08 One-sided countersunk screw mounting.
   09 Provide acoustic sealant at sound-control doors or where acoustic glazing is being used.
   10 When installed in rated doors, ensure lite kit rating matches that of door. Provide rated glazing tape as required.

2.5 FABRICATION

A. Stile Edges: Apply hardwood edges before application of face laminates.

B. Prefit Doors:
   01 Prefit and bevel doors at factory to fit openings.
   02 Prefit Tolerances: WDMA I.S.1-A.

C. Factory-machine doors for mortised hardware, including pilot holes for hinge screws and lock fronts required.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine locations to receive doors. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not begin installation until unacceptable conditions are corrected.

B. Ensure frames are solidly anchored, allowing no deflection when doors are installed.

C. Ensure frames are plumb, level, square, and within tolerance.

D. Allow doors to become acclimated to building temperature and relative humidity for a minimum of 24 hours before installation.

3.2 INSTALLATION

A. Carefully verify that doors are properly installed at intended door location and that door prep for finish hardware is accurate and complete.

B. Install all doors plumb and square to frame with +/- 1/8” clearance between door and frame.

C. Install finish hardware in accordance with approved templates.

D. Verify that top and bottom rails are sealed prior to door installation.

E. Take all necessary precautions to protect door finishes before, during and after installation. In the event of damage to the plastic laminate surfacing, replace door.

F. Do not strip heads of Phillips head screws. Remove and replace all stripped screws.

G. Upon completion of door installation, cycle door several times to confirm that door, frame and hardware are all installed and functioning correctly.

END OF SECTION

SECTION 08 31 13

ACCESS DOORS

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Access flush access doors where indicated on the Drawings.
   02 Access flush access doors at all plumbing chases. Coordinate locations with Architect.
   03 Provide flush access doors in horizontal gyp board and / or plaster ceilings or soffits as indicated on the Drawings.
   04 Where access doors are installed in a rated partition or assembly, provide fire-rated access doors.

C. Related Work:
   01 Section 04 20 00 – Unit Masonry.
   02 Section 09 21 16 – Gypsum Board Assemblies.
   03 Divisions 22 and 23 – Access doors for plumbing and mechanical items.
   04 Division 26 – Access doors for electrical items.

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies. Show details of field fabrications, connections and details.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

E. Color / Finish Samples:
   01 Provide two (2) samples of each finish for selection by the Architect.

02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
03 Minimum size shall be 3” x 3” but must be large enough to convey attributes of the proposed product.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Design of access doors is based on products manufactured by Milcor, Inc.

B. Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this section, provide all proposed products meet or exceed all specified requirements.
01 Acudor Products Inc.
02 Ruskin Company.
03 The Bilco Company.

2.2 MATERIALS

A. Design of access doors is based on Milcor:
01 Series M Architectural Access Door for non-fire-rated assemblies.
02 Series UFR Universal Fire Rated Access Door for rated assemblies.

2.3 ACCESS DOORS – NON-FIRE-RATED

A. Design of non-fire-rated access doors is based on Milcor Series M Architectural Access Door.

B. Door: 16 gauge. cold rolled steel.

C. Frame: 16 gauge. cold rolled steel. Frame to be provided with pre-formed mounting holes 3/16“ diameter at 4” spacing. Inner frame included to allow latching.
01 Provide cadmium plated or stainless steel screws as appropriate for wall substrate.

D. Hinge: Concealed spring hinges open to 175° for complete access without allowing the door to impact the wall. Quantity varies per door panel size. Extracting pin from hinge leaf attached to panel permits panel removal.

E. Latch: Cylinder lock (replaces one cam latch) furnished with two keys. Additional custom options available upon request. Key locks to Cat 60 key.

F. Finish: Powder coat colors - Grey, Gold Sand, Jet Black as selected by the Architect.

G. Sizes: Unless otherwise indicated on the Drawings, provide the following:
01 Single User Restrooms: 24” x 24”.
02 Multi User Restrooms: 24” x 24”.
03 Gypsum Board Ceilings: 24” x 24”.
04 Plaster Ceilings and Soffits: 24” x 24”.

2.4 ACCESS DOORS – FIRE-RATED

A. Design of non-fire-rated access doors is based on Milcor Series UFR Universal Fire Rated Access Door.

B. Door: 20 gauge cold rolled steel sandwich panel with 2” mineral fiber insulation.

C. Frame: 16 gauge 4-piece cold rolled steel with masonry anchors.

D. Hinge 18 gauge continuous piano hinge with stainless steel pin.

E. Closer: Coil spring self-closing.

F. Latch: Self-latching paddle latch and locking system with key operated cylinder lock furnished with two keys and interior release mechanism; (1) per door for sizes below 36”; (2) per door for sizes 36” - 48”. Key locks to Cat 60 key.

G. Rating
   01 Rating is maintained for a two hour wall.
   02 Carries UL and CUL 1½ -hour, Class B fire rating.
   03 Warnock Hersey Label for three-hour noncombustible ceiling systems.
   04 UL Certified: 250° F temperature rise protection for cold rolled steel; 450° F temperature rise protection for stainless steel.

H. Finish: Powder coat colors - Grey, Gold Sand, Jet Black as selected by the Architect.

I. Sizes: Unless otherwise indicated on the Drawings, provide the following:
   01 Single User Restrooms: 24” x 24”.
   02 Multi User Restrooms: 24” x 24”.
   03 Gypsum Board Ceilings: 24” x 24”.
   04 Plaster Ceilings and Soffits: 24” x 24”.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate locations with the trade that is constructing the material being penetrated.

B. Verify by comparing packing slip and box label that product is per specification.

C. Verify that the substrate is dry, clean, and free of foreign matter and in compliance with requirements for installation tolerances and other conditions affecting performance. Report and correct any defects prior to any installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

E. Refer to manufacturer’s product literature for surface preparation requirements.
   01 Surfaces should be structurally sound, free of voids, spalls, loose aggregate and sharp ridges. Remove dust, dirt, debris or any other foreign materials.

3.2 INSTALLATION

A. Install access doors in strict accordance with manufacturer's instructions and approved submittals.

B. Take all necessary precautions to protect adjacent work and finishes. Coordinate with other trades to repair finishes and other damaged during installation.

C. Test units for proper function and adjust until proper operation is achieved.

D. Restore finishes so no evidence remains of corrective work.

3.3 ADJUSTING AND CLEANING

A. Remove and replace access doors with damage, bowing, or warping that interferes with the installation or functionality of product.

B. Clean exposed surfaces using methods acceptable to the manufacturer which will not damage finish.

C. Protect completed work from subsequent construction activities as recommended by manufacturer.

END OF SECTION

SECTION 08 33 23.13

OVERHEAD COILING PERFORATED SLAT GRILLES

CONDITIONS OF THE CONTRACT, SUPPLEMENTARY CONDITIONS AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers and Section 00 63 25 – Subcontractor / Manufacturer Prequalification for substitutions.

B. Scope of Work:
   01 Provide overhead coiling perforated slat grilles where indicated or scheduled on the Drawings.
   02 Overhead grilles shall be complete with structural supports, grille, guides, hood and electric operation.

C. Related Work:
   03 Section 04 20 00 – Unit Masonry
   04 Section 05 12 00 – Structural Steel Framing
   05 Section 05 50 00 – Metal Fabrications
   06 Section 08 71 00 – Door Hardware
   07 Section 09 21 16 – Gypsum Board Assemblies
   08 Section 09 51 13 – Acoustical Tile Ceilings

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.
   04 Include size(s), grillage, track and hardware along with wiring diagrams.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01 Include recommended cleaning products and instructions for use.

02 Where applicable, provide recommended maintenance schedules and procedures.

F. Color / Finish Samples
01 Provide two (2) samples of each curtain door with specified finish for selection by the Architect.
02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.

G. Operations and Maintenance Manuals
01 Provide complete operations and maintenance manuals to the Owner.
02 Refer to section 01 78 23 – Operations and Maintenance Manuals
03 O & M manuals must be reviewed, accepted and delivered to the Owner prior to Owner demonstration(s).

1.3 WARRANTY

A. Warrant the work specified herein for five (5) years from date of substantial completion against becoming unserviceable or causing an objectionable appearance, resulting from either defective or nonconforming materials or workmanship.

B. Defects shall include, but not be limited to the following:
01 Rough or difficult operation.
02 Noisy operation.
03 Loose or missing parts.
04 Noticeable deterioration of finish.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Design of overhead coiling perforated slat doors is based on products furnished by CornellCookson.

B. The following manufacturers are acceptable provide the proposed products and assemblies meet or exceed all specified requirements;
01 Cookson Co.
02 Wayne-Dalton Corp
03 McKeon Rolling Steel Door Co.
04 Holiday Gate & Door Systems, Inc.

2.2 MATERIALS

A. Design of overhead coiling perforated slat doors is based on CornellCookson model ESD 10 Aluminum Coiling Overhead Door with Screengard perforated slats.

B. Curtain:
01 Slat Material: No. 5P
a. 16-gauge (0.025”) aluminum minimum.
b. Aluminum curtain with aluminum bottom bar.
02 Provide Screengard perforated slats
03 Curtain Finish: Clear anodized aluminum.

04 Bottom Bar: Extruded aluminum tubular section, minimum 3-3/8 inch height up to 21'-5" wide; double aluminum angles over 21'-5" wide. Finish to match curtain.

C. Guides:
01 Mounting: Shall be between jamb type.
02 Mounting Support: Self-supporting steel tube, minimum 3" x 3".
03 Guides: Constructed of minimum 3/16" aluminum angles, bolted together to form guide gap.
04 Provide aluminum angles at face as required to trim out to face of wall.
05 Provide removable guide stoppers to prevent over travel of curtain and bottom bar
06 Guides to be surface-mounted only; do not recess into wall.
07 Finish: clear anodized aluminum.

D. Counterbalance Shaft Assembly:
01 Barrel: Steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot (2.5 mm per meter) of width.
02 Spring Balance: Oil-tempered, heat-treated steel helical torsion spring assembly designed and balanced for fail-safe automatic opening of grille. Provide wheel for applying and adjusting spring torque.
03 Brackets: Fabricate from minimum 3/16 inch (6.35 mm) steel plate with permanently lubricated ball or roller bearings at rotating support points to support counterbalance shaft assembly and form end closures.
04 Finish: Type 304 stainless steel with #4 finish

E. Hood & Fascia (coil above ceiling): Minimum 24-gauge galvanized steel. Reinforced to prevent hood deflection.
01 Provide minimum 1/4 inch (6.35 mm) steel intermediate support brackets as required to prevent excessive sag.
02 Finish: Mill finish aluminum

F. Provide recessed wall key switch with interlock safety feature for each door; keyed to building system. Provide Securitron MK 2 door key switch with Best removeable core on both sides of door at all locations; (2) per door.

G. Motor Operation at Doors:
01 The operator must not extend above or below the door coil when mounted front-of-coil.
02 Rated for a maximum of 20 cycles per hour (not to be used for consecutive hours) cULus listed (to comply with UL requirements in The United States and Canada)
03 Totally Enclosed Non-Ventilated gear head operators rated 1/3 hp as recommended by door manufacturer for size and type of door, 120 Volts, 1 Phase.
04 Provide complete with electric motor and factory pre-wired motor control terminals, maintenance-free solenoid actuated brake, and control stations.
05 Motor shall be high starting torque, industrial type, protected against overload with an auto-reset thermal sensing device.
06 Primary speed reduction shall be heavy-duty, lubricated gears with mechanical braking to hold the door in any position.
07 Operator shall be equipped with an emergency manual chain hoist assembly that safely cuts operator power when engaged. A disconnect chain shall not be required to engage or release the manual chain hoist.

08 Operator drive and door-driven sprockets shall be sized for #50 roller chain.

09 Provide an integral motor mounted interlock system to prevent damage to door and operator when mechanical door locking devices are engaged.

10 Operator shall be capable of driving the door at a speed of up to 9” per second or as recommended for door size.

11 Fully adjustable, driven linear screw-type cam limit switch mechanism shall synchronize the operator with the door.

12 The electrical contractor shall mount the control stations and supply the appropriate disconnect switch, all conduit and wiring per the motor operator wiring instructions

H. Control Station:

01 Flush mounted: "Open/Close" key switch with "Stop" push button; NEMA 1B.

a. Key switch shall have a removable Best cylinder capable of being keyed to standard district keying system.

02 2-wire, E.L.R. electric sensing edge extending full width of door bottom bar. Conceal wire to pressure bar bottom bar sensor inside door jamb. Sensor bar wire shall not be exposed. Alternate option is to use a wireless sensing device.

03 Provide a retracting safety cord and reel connection to control circuit.

I. Locking:

01 Non-egress units are provided with a supplementary masterkeyable cylinder lock operable from coil side of opening at operator side of bottom bar. Motor interlock switch provided.

a. Best 7-pin removeable core cylinder.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and adjacent work which will interface with the installation.

01 Confirm all other work is suitably complete and will properly interface.

02 Coordinate with Contractor and other trades as required to resolve issues and discrepancies.

03 Do not proceed until substrates and adjacent work are satisfactory.

B. Coordinate with other trades for requirements of ceiling opening to accommodate the overhead grille operation.

C. Coordinate with electrical contractor for proper interface and operation.

D. Commencement of work by installer is acceptance of substrate and adjacent work.

3.2 INSTALLATION

A. General: Install overhead grille and operating equipment with necessary hardware, anchors, inserts, hangers and supports in strict accordance with manufacturer’s installation instructions and final reviewed submittals.

B. Overhead grille shall be installed level and plumb to provide smooth, proper operation.

C. Adjusting: Following completion of installation, including related work by others, lubricate, and adjust grilles for ease of operation, free from warp, twist, or distortion.
   01 Verify the jamb openings (by others) do not and will not interfere with grille during operation.

D. Access to items that require service/replacement should not be blocked by masonry, conduits, other MEP systems, etc.

3.3 CLEANING AND TESTING

A. Thoroughly clean all component of overhead grille.

B. Test all functions to assure smooth operation without potential conflict with other adjacent assemblies.

C. Coordinate with Contractor and Owner to provide demonstration of the correct operation of the overhead grille.
   01 Owner demonstration shall not be conducted until O&M manuals have been submitted, reviewed, accepted and delivered to Owner for their use and reference during Owner training.
   02 Demonstrate to the Owner's Project Manager after door assembly has been fitted, aligned, adjusted and cleaned of dirt and grease for smooth operation prior to substantial completion.

END OF SECTION

SECTION 08 33 23.16

OVERHEAD INSULATED COILING DOORS

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide overheard insulated coiling doors in sizes and locations as indicated on the Drawings.
   02 Assemblies shall be complete, including guides, hoods, chain operator, weather seals and accessories.

C. Related Work:
   01 Section 04 20 00 – Unit Masonry
   02 Section 05 50 00 – Metal Fabrications
   03 Section 07 42 13 – Metal Wall Panels
   04 Section 08 11 13 – Hollow Metal Doors and Frames
   05 Section 08 71 00 – Door Hardware
   06 Section 09 21 16 – Gypsum Board Assemblies.
   07 Section 13 34 19 – Metal Building Systems.

1.2 SUBMITTALS

A. Provide all submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.
   04 Provide engineering and calculations demonstrating compliance with wind load and other requirements.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01 Include recommended cleaning products and instructions for use.
   02 Where applicable, provide recommended maintenance schedules and procedures.

F. Color / Finish Samples
   01 Provide two (2) samples of each finish for selection by the Architect.
   02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
   03 Minimum size shall be 3" x 3", but must be large enough to convey the finish attributes of the proposed product.

G. Operation and Maintenance (O&M) Manuals prior to Substantial Completion

H. Sample copy of manufacturer's warranty

1.3 REFERENCES

A. ASTM International
   01 ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   02 ASTM A 924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
   03 ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   04 ASTM E 90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Element.
   05 ASTM E 330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

B. American National Standards Institute (ANSI)
   01 ANSI / DASMA 108 - American National Standards Institute Standard Method For Testing Sectional Garage Doors And Rolling Doors: Determination Of Structural Performance Under Uniform Static Air Pressure Difference.

C. National Electrical Manufacturers Association (NEMA)
   01 NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
   02 NEMA MG 1 - Motors and Generators.

1.4 SYSTEM DESCRIPTION

D. Design Requirements:
   01 Wind Loading: Refer to section 01 11 23 – Code Summary
   02 Cycle Life: Design doors of standard construction for normal use of up to 20 cycle per day maximum.
   03 Insulated Door Slat Material Requirements:
      a. Flame Spread Index of 0 and a Smoke Developed Index of 10 as tested per ASTM E84.
      b. Minimum Sound Transmission Class (STC) rating of 26 as tested per ASTM E90.

c. Minimum R-value of 8.0 (U-factor of 0.125) as calculated using the ASHRAE Handbook of Fundamentals.
d. Insulation to be CFC Free with an Ozone Depletion Potential (ODP) rating of zero.

1.5 WARRANTY

A. Warrant the work specified herein for five (5) years from date of substantial completion against becoming unserviceable or causing an objectionable appearance, resulting from either defective or nonconforming materials or workmanship.

B. Defects shall include, but not be limited to the following:
01 Rough or difficult operation.
02 Noisy operation.
03 Loose or missing parts.
04 Noticeable deterioration of finish.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Design of overhead coiling doors is based on products manufactured by CornellCookson.

B. The following manufacturers are acceptable provided proposed products meet or exceed performance and attributes of basis of design, and specified requirements:
01 Overhead Door Co. (chain/manual operated only)
02 McKeon Rolling Steel Door Co.
03 Wayne Dalton Corp.
04 Holiday Gate & Doors Systems Inc.

2.2 MATERIALS

A. Design of overhead insulated coiling doors is based on CornellCookson Model ESD30 Insulated Coiling Overhead Door.

B. Curtain:
01 Slat Material: No. 6F, (Listed Exterior/Interior):
a. Galvanized Steel/Galvanized Steel: 18/24 gauge, Grade 40, ASTM A653 galvanized steel zinc coating.
b. Insulation: 7/8 inch (22 mm) foamed-in-place, closed cell urethane.
c. Total Slat Thickness: 15/16 inch (24 mm).
d. Slats have a Flame Spread Index of 0 and a Smoke Developed Index of 10 as tested per ASTM E84.
e. Slat shall have an R-value of 8.0 and an STC rating of 26 minimum.
02 Interlocking, formed shop designed to resist 30 PSF wind load.
03 Bottom Bar: Reinforced extruded aluminum interior face with full depth insulation and exterior skin slat to match curtain material and gauge.
04 Fabricate interlocking sections with high strength nylon end-locks or cast iron endlock/windlocks on alternate slats each secured with two 1/4"

(6.35 mm) rivets. Provide windlocks as required to meet specified wind load.

05 Exterior Slat Finish:
   a. GalvaNex™ Coating System and phosphate treatment followed by baked-on polyester powder coat at Athletic Storage and Pressbox

06 Interior Slat Finish: GalvaNex™ Coating System to include an ASTM A653 galvanized base coating treated with dual process rinsing agents in preparation of a chemical bonding, light gray baked-on polyester base coat and a flat black baked-on polyester finish coat.

07 Bottom Bar Finish:
   a. Exterior Face: Match slats.
   b. Interior Face: Mill finish

C. Guides:

01 Fabricate with minimum 3/16 inch structural steel angles. Guides to be surface-mounted only; do not recess into wall. Separate dissimilar metals (where applicable).

02 Provide windlock bars of same material when windlocks are required to meet specified wind load. Top of inner and outer guide angles to be flared outwards to form bellmouth for smooth entry of curtain into guides. Provide removable guide stoppers to prevent over travel of curtain and bottom bar,

03 Top 16-1/2" (419.10 mm) of coil side guide angles to be removable for ease of curtain installation and as needed for future curtain service.

04 Mounting Support: Provide minimum 3” x 3” x 1/4” structural steel tubes at jambs with base plates at jambs of doors for mounting support as required.

05 Finish: Steel: ASTM A123, Grade 85, zinc coating, hot-dip galvanized after fabrication.

D. Counterbalance Shaft Assembly:

01 Barrel: Steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot of width.

02 Spring Balance: Oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of door to ensure that maximum effort to operate will not exceed 25 lbs. Provide wheel for applying and adjusting spring torque.

E. Brackets: Fabricate from minimum 3/16 inch steel plate with permanently lubricated ball or roller bearings at rotating support points to support counterbalance shaft assembly and form end closures.

01 Finish: ASTM A123, Grade 85 zinc coating, hot-dip galvanized after fabrication.

F. Hood at steel door: 24 gauge galvanized steel with reinforced top and bottom edges. Provide minimum 1/4 inch (6.35 mm) steel intermediate support brackets as required to prevent excessive sag.

01 Finish: GalvaNex™ Coating System and phosphate treatment followed by baked-on polyester powder coat, color as selected by Architect from manufacturer's standard color range, flat black

G. Weatherstripping:

01 Bottom Bar: Replaceable, bulb-style, compressible EDPM gasket extending into guides.

02 Guides: Replaceable vinyl strip on guides sealing against fascia side of curtain.
03 Lintel Seal: Nylon brush seal fitted at door header to impede air flow.
04 Hood: Neoprene/rayon baffle to impede air flow above coil.

2.3 OPERATORS

A. Operation - Manual Chain Hoist:
01 Provide chain hoist operator with endless steel chain, chain pocket wheel and guard, geared reduction unit, and chain keeper secured to guide.
02 Chain hoist to include integral brake mechanism that will immediately stop upward or downward travel and maintain the door in a stationary position when the hand chain is released by the user.

B. Accessories: Provide all accessories required for a complete, operable assembly in accordance with manufacturer's standards and recommendations.

C. Locks: Provide sliding lateral bolt and cylinder that accepts a "Best" core, one at each jamb, to be operated from the inside of the door. Coordinate with Door Hardware Specification – 08 71 00.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine substrates, areas, and conditions for compliance with requirements for substrate construction and other conditions affecting performance of the work.

B. Examine locations of electrical connections.

C. Proceed with installation only after all unsatisfactory conditions have been corrected.

D. Coordinate with electrical contractor as required for proper rough-in and final connections required for a fully functional assembly.

3.2 INSTALLATION

A. Install in strict accordance with manufacturer's printed instructions and recommendations at locations shown on Drawings.

B. Anchor to adjacent construction without distortion or stress.

C. Fit and align door and shutter assembly including hardware, plumb, level and square to ensure smooth operation.

D. Adjust hardware and moving parts so that doors operate smoothly throughout full operating range.

E. Adjust seals to provide a tight fit around the entire perimeter.

3.3 CLEANING

A. Clean surfaces soiled by work as recommended by manufacturer.

B. Remove surplus materials and debris from the site.

3.4 DEMONSTRATION

A. Prior to Owner demonstration, submit and receive approval of operation and maintenance manuals required in section 01 77 00 – Close-Out Procedures. Provide O&M manuals to Owner prior to conducting Owner demonstration.

B. Demonstrate to the Owner's Project Manager after door assembly has been fitted, aligned, adjusted and cleaned of dirt and grease for smooth operation prior to substantial completion.

C. Instruct Owner's Representative in maintenance procedures.

END OF SECTION

SECTION 08 34 73

SOUND CONTROL DOOR ASSEMBLIES

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide all interior and exterior hollow metal doors and frames, including interior glazed opening frames, where indicated on the Drawings.
   02 Where indicated on the Drawings, provide UL labeled fire rated hollow metal frames.

C. Related Work:
   01 Section 07 92 00 – Joint Sealants
   02 Section 08 11 13 – Hollow Metal Doors and Frames
   03 Section 08 14 23.16 – Plastic-Laminate-Faced Wood Doors
   04 Section 08 71 00 – Door Hardware
   05 Section 08 80 00 – Glazing
   06 Section 09 21 16 – Gypsum Board Assemblies

1.2 SUBMITTALS

A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.

D. Finish Hardware Location: Hollow metal manufacturer shall obtain an approved hardware schedule, hardware templates and samples of physical hardware where necessary to ensure correct fitting and installation.

E. Certification: Door construction utilized has been tested at an independent laboratory in accordance with ASTM E90-90, and that the STC determined in accordance with ASTM E413-87 is not less than that specified in Part 2 of this Section. Door construction has been tested in accordance with ASTM E512-81A (UL-10b) for labeled fire doors and frames, and meets requirements of NFPA 80 where required.

F. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

G. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01 Include recommended cleaning products and instructions for use.
   02 Where applicable, provide recommended maintenance schedules and procedures.

H. Color / Finish Samples:
   01 Provide two (2) samples of each finish proposed to be furnished for selection by the Architect.
   02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
   03 Minimum size shall be 3" x 3", but must be large enough to convey attributes of the proposed product.

I. Operations and Maintenance Manuals:
   01 Provide complete operations and maintenance manuals to the Owner.
   02 Refer to Section 01 78 23 – Operations and Maintenance Manuals.
   03 O & M manuals must be reviewed, accepted and delivered to the Owner prior to Owner demonstration(s).

J. For warranties longer than one (1) year, submit a sample of the warranty proposed to be furnished.

1.3 REFERENCES

A. American Society for Testing Materials (ASTM):
   01 ASTM A1008 – Standard Specification for Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.
   02 ASTM A1011 – Standard Specification for Steel, Hot-Rolled Sheet and Strip, Commercial.
   03 ASTM C1036-01 – Standard Specification for Flat Glass
   04 ASTM C1172-03 – Standard Specification for Laminated Architectural Flat Glass
   05 ASTM E90 – Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss in Building Partitions.
   06 ASTM E336 – Standard Test Method for Measurement of Airborne Sound Insulation in Buildings.
   07 ASTM E413-87 – Classification for Rating Sound Insulation
   08 ASTM E512 – Standard Practice for Combined, Simulated Space Environment Testing of Thermal Control Materials with Electromagnetic and Particulate Radiation

B. Underwriters Laboratory (UL):
   01 UL10B: Fire Tests of Door Assemblies
   02 UL10C: Positive Pressure Fire Tests of Door Assemblies

C. National Fire Protection Association (NFPA):

01 NFPA 80: Standard for Fire Doors and Fire Windows

1.4 WARRANTY

A. Manufacturer to warranty the materials specified in this section to be free from defects in material and workmanship for a period of five (5) years from the date of substantial completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Design of sound control door assemblies is based on products manufactured by Overly Manufacturing Company.

B. Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this Section, provided all proposed products meet or exceed the specified requirements.
   01 IAC Acoustics
   02 Protective Door Industries
   03 Wenger

2.2 MATERIALS

A. Design of Acoustical door assemblies is based on Overly Door Company Model No. 5192288.
   01 Minimum STC Rating Of Assembly: 51.
   02 Swinging doors to be complete with frame, cam-lift hinges, sound seals, retainers and covers.
   03 Fixed window frames to be complete with gaskets, and purging ports for inert gas evacuation of water vapor.

B. Materials:
   01 Acoustical doors, door frames, and window frames to be constructed from formed sheet shapes or structural shades and bars.
   02 Sheet steel shall be commercial quality, level, cold rolled steel conforming to ASTM A366 or hot rolled, pickled and oiled steel conforming to ASTM A569. Steel shapes shall comply with ASTM A36 and bars with ASTM A108, Grade 1018.
   03 Door Size: 1-3/4” thick in sizes indicated or scheduled on the Drawings.
   04 Nominal weight of door: 12 PSF.
   05 Minimum Frame Thickness: 16 gauge.

C. Glass:
   01 Provide glass lites, if any, in doors in sizes as indicated on the Drawings.
   02 Glazing shall be Overly 3/8” Clear Acousta-Pane 38.
   03 Glass shall be laminated safety glass comprised of two (2) panes of 3/16” clear tempered glass with a 0.30” polyvinyl Butyral (PVB) membrane.
   04 Glass shall comply with ASTM C1036-01 and C1172-03.

2.3 FABRICATION

A. General: Assemble work using all welded construction conforming to applicable requirements of AWS D1.1.

01 Doors and frames shall be provided as specific units for each sound door.

B. Door Design:
01 Acoustical doors shall be constructed with flush faces.
02 No visible seams shall be permitted on door faces.
03 Internal construction and door edge configuration shall be manufacturers standard for the specified model.

C. Frame Design:
01 Acoustical door and window frames shall be welded units with integral trim.
02 Provide door frames in sizes and profiles as indicated on the Drawings.

D. Hardware Reinforcements:
01 Coordinate hardware requirements with Section 08 71 00 – Door Hardware.
02 Factory mortise, reinforce, drill, and tap doors and frames for all mortise hardware.
03 Provide reinforcing plates for surface-type hardware; all drilling and tapping to be done in field.
04 Provide dust cover boxes on frame mortises.

E. Anchors: Provide suitable anchors to properly install frames in partition types shown on the Drawings.

F. Provide “S-6” sill threshold at each door.

G. Provide all integral sound seals at door frame jambs and head, and door edges as required to achieve specified STC rating.

H. Glazing: provide tempered, insulated acoustical glass at door lite.

I. After fabrication, all tool marks and surface imperfections shall be removed and exposed faces of all welded joints dressed smooth.
01 Chemically treat all surfaces to insure maximum paint adhesion and coat with a water-based rust-inhibitive primer.
02 Coordinate with Section 09 91 00 – Painting and Re-Painting as required.

PART 3 - EXECUTION

3.1 PREPARATION

A. Thoroughly examine adjacent substrates and assemblies to determine all interfacing Work is installed to accommodate the proper installation of sound control doors and frames.
01 Coordinate with other trades as required.

B. Notify Contractor of any deficiencies or issues that prevent proper installation.

C. Do not proceed until all discrepancies have been fully resolved.

D. Store all materials on planks or dunnage in a dry location in a vertical position, spaced by blocking to permit air circulation between units.

E. Cover all material or store in a controlled area to protect from damage.

3.2 INSTALLATION

A. Prior to installation, secure the services of manufacturer's factory trained and authorized installer to perform installation of assemblies.

B. Install work of this Section in strict accordance with manufacturer's recommended installation instructions and final reviewed submittals.

C. Where installations require field welding, all work must be performed by certified welders in accordance with AWS D1.1/D1.3.

3.3 CLEANING AND TESTING

A. Upon completion of installation, thoroughly clean all assembly components.

B. Upon installation, secure the services of a qualified representative of the manufacturer to visit the jobsite and inspect the complete installation of the door and frame assemblies, test all components thru a minimum of ten (10) cycles of operation and direct installer in correcting any non-conforming items found.

END OF SECTION

SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.
2. Sliding doors.
3. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware.
3. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section “Hollow Metal Doors and Frames”.
2. Division 08 Section “Flush Wood Doors”.
3. Division 08 Section “Aluminum-Framed Entrances and Storefronts”.
4. Division 28 Section “Access Control Hardware Devices”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.
4. UL 305 - Panic Hardware.
5. ANSI/UL 437- Key Locks.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
3. Content: Include the following information:

    a. Type, style, function, size, label, hand, and finish of each door hardware item.
    b. Manufacturer of each item.
    c. Fastenings and other pertinent information.
    d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    e. Explanation of abbreviations, symbols, and codes contained in schedule.
    f. Mounting locations for door hardware.
    g. Door and frame sizes and materials.
    h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

    a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
    b. Complete (risers, point-to-point) access control system block wiring diagrams.
    c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

1.4 CLOSEOUT SUBMITTALS

A. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

B. Project Record Documents: Provide record documentation of as-built door hardware sets in digital format (.pdf, .docx, .xlsx, .csv) and as required in Division 01, Project Record Documents.

1.5 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.

2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

F. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.

G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

I. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

1.6 DELIVERY, STORAGE AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.7 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.8 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 BUTT HINGES

A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:

a. Two Hinges: For doors with heights up to 60 inches.
b. Three Hinges: For doors with heights 61 to 90 inches.
c. Four Hinges: For doors with heights 91 to 120 inches.

d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
b. Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:

a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for all out-swinging lockable doors.

5. Manufacturers:

a. McKinney (MK) - TA/T4A Series, 5-knuckle.

2.2 POWER TRANSFER DEVICES

A. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

a. Pemko (PE) - EL-CEPT Series.
b. Securitron (SU) - EL-CEPT Series.

B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:

a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
b. McKinney (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

a. McKinney (MK) - QC-C Series.

2.3 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:

1. Threaded mortise cylinders with rings and cams to suit hardware application.
2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
4. Tubular deadlocks and other auxiliary locks.
5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
6. Keyway: Manufacturer’s Standard.

C. Small Format Interchangeable Cores: Provide small format interchangeable cores (SFIC) as specified, core insert, removable by use of a special key; usable with other manufacturers' cylinders.

D. Keying System: Each type of lock and cylinders to be factory keyed.

1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. New System: Key locks to a new key system as directed by the Owner.

E. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Two (2)
2. Master Keys (per Master Key Level/Group): Five (5).
3. Construction Keys (where required): Ten (10).

F. Construction Keying: Provide construction master keyed cylinders.

G. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

2.4 KEY CONTROL

A. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Manufacturers:

a. Lund Equipment (LU).
b. MMF Industries (MM).
c. Telkee (TK).

B. Electronic Key Management System: Provide an electronic key control system with Stand-alone Plug and Play features including advanced RFID technology. Touchscreen interface with PIN access for keys individually locked in place. Minimum 1,000 system users and 21 iFobs for locking receptors. System shall have a minimum 250,000 audit events screen displayed or ability to be exported via USB port.

1. Manufacturers:

a. Medeco (MC).

2.5 MORTISE LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): Provide ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed mortise locksets. Listed manufacturers shall meet all functions and features as specified herein.

1. Manufacturers:

a. ASSA ABLOY ACCENTRA, formerly known as Yale (YA) - 8800FL Series.
b. Corbin Russwin Hardware (RU) - ML2000 Series.
c. Sargent Manufacturing (SA) - 8200 Series.

2.6 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.

2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.7 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. Exit devices shall have a five-year warranty.
2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer’s catalog and template book for specific requirements.
4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.

    a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
    b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.
9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed exit devices. Listed manufacturers shall meet all functions and features as specified herein.

1. Manufacturers:

    a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
    b. Sargent Manufacturing (SA) - 80 Series.

2.8 SURFACE DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Heavy duty surface mounted door closers shall have a 30-year warranty.

2. Manufacturers:

a. ASSA ABLOY ACCENTRA, formerly known as Yale (YA) - 4400 Series.
b. Corbin Russwin Hardware (RU) - DC6000 Series.
c. Norton Rixson (NO) - 7500 Series.
d. Sargent Manufacturing (SA) - 351 Series.

2.9 SURFACE MOUNTED CLOSER HOLDERS

A. Electromagnetic Door Holders: ANSI A156.15 electromagnetic door holder/releases with a minimum 20 to 40 pounds holding power and single coil construction able to accommodate.12VDC, 24VAC, 24VDC and 120VAC. Coils to be independently wound, employing an integral fuse and armatures to include a positive release button.

1. Manufacturers:

a. Norton Rixson (RF) - 980/990 Series.
b. Sargent Manufacturing (SA) - 1560 Series.

2.10 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NFPA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. Pemko (PE).

2.11 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.12 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Push Plates and Door Pulls: When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.

E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

F. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.
2. The supplier is responsible for handing and sizing all products.
3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Manufacturer's Abbreviations:

1. MK - McKinney
2. OT - Other
3. PE - Pemko
4. SU - Securitron
5. RO - Rockwood
6. PR - BEST Precision
7. SA - SARGENT
8. BE - BEST Locks & Closers
9. HS - HES
10. RF - Rixson
11. AK - Alarm Controls

Hardware Sets

Set: 1.0

Doors: C100-1, C120-1
Description: Add SN200 Reader

1	SN200 Reader	52 6027 (Exit / Lock)	26D	SA
1	Balance of hardware	Existing to remain		OT

Set: 2.0

NOT USED
Description: New SN200 lock w/ closer

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Electric Power Transfer	EL-CEPT	630	SU
1	SN200 Lock	70 SN200 8204 LL	US26D	SA
1	Door Closer	TB 351 O/P9 (type as required)	EN	SA
1	Door Stop	481H	US26D	RO
3	Silencer	608		RO

Set: 3.0

Doors: P129-1, Q101-2
Description: Add Exit Device-8816

1	Rim Exit Sec CR x SPAR#NC-E11	19 LD 43 49 70 8816 ETL	US32D	SA
2	Interchangeable Core	I/CK-7	626	BE
2	Const. Core	7190224	Green	BE
1	Balance of hardware	Existing to remain		OT

Set: 4.0

Doors: B100-2, D100-1, D114-1, D120-1, F100-1, N104-1, U105-1, X100-1, X100-2, X111-3, X117-1, A100-1, A104-1, A127-1, B104-1, C124-1, , J110-2, J110-4, M104-2, S109-2, W100-2, W108-2, X102-1, Y100-1, Y121-2, M104-1, C124-1, E100-1
Description: Add SN200 Exit at RHR leaf only, Loop

1	Rim Exit x SPAR04867/NC-E11	19 LD TB 43 70 56-SN200-8804	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-C***P (length as req'd)		MK
1	Door Loop	DL-2		AK
1	Power Supply	Provided by security		SU

1	Balance of hardware	Existing to remain		OT

Notes: Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times. Reuse existing Trim. Remove cylinder dogging on exiting rail with 68-1375 mounting rail insert.

Set: 5.0

Doors: J100-1, J100-3, J110-1, Q101-1, R100-1, R121-1

Description: Add SN200 Exit at RHR leaf only, Loop x EPT

1	Power Transfer	EL-CEPT	630	SU
1	Rim Exit x SPAR04867/NC-E11	19 LD TB 43 70 56-SN200-8804	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	ElectroLynx Harness	QC-C1500P		MK
1	ElectroLynx Harness	QC-C***P (length as req'd)		MK
1	Door Loop	DL-2		AK
1	Power Supply	Provided by security		SU
1	Balance of hardware	Existing to remain		OT

Notes: Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times. Reuse existing Trim. Remove cylinder dogging on exiting rail with 68-1375 mounting rail insert.

Set: 6.0

Doors: D128-2

Description: Add 2N Station w/ 8804 Exit, Loop

1	Rim Exit - 2N SPAR#04867/NC-E11	LD 19 TB 43 56 70 8804 Less Pull	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	ElectroLynx Harness	QC-C1500P		MK
1	ElectroLynx Harness	QC-C***P (length as req'd)		MK
1	Door Loop	DL-2		AK
1	Power Supply	Provided by security		SU
1	Balance of hardware	Existing to remain		OT

Notes: Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times. Card reader by security.
Reuse existing Trim.

Set: 7.0

Doors: C116-2
Description: Add SN200 exit, loop

1	Rim Exit x SPAR04867/NC-E11	19 LD TB 43 70 56-SN200-8804	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	ElectroLynx Harness	QC-C1500P		MK
1	ElectroLynx Harness	QC-C***P (length as req'd)		MK
1	Door Loop	DL-2		AK
1	Power Supply	Provided by security		SU
1	Balance of hardware	Existing to remain		OT

Set: 8.0

Doors: A103-1
Description: Existing - Add 8204 OL

1	Storeroom/Closet Lock	70 8204 OL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Balance of hardware	Existing to remain		OT

Set: 9.0

Doors: C106-2, C115-1, P101-1, P104-2, R119-2, T101-1
Description: Existing add 8204 LL

1	Storeroom/Closet Lock	70 8204 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Balance of hardware	Existing to remain		OT

Set: 10.0

Doors: E212-1, G118-1
Description: Existing - Add 8238 and parallel HO closer arm

1	Classroom Security Intruder Lock	V01 EMB 70 8238 VN1L 90-3/8" Collar	US26D	SA
2	Interchangeable Core	I/CK-7	626	BE
2	Const. Core	7190224	Green	BE
1	Parallel Hold Open Arm	25-PSH	EN	SA
1	Balance of hardware	Existing to remain		OT

Set: 11.0

Doors: C116-1, R119-1

Description: Existing - Add 8238

1	Classroom Security Intruder Lock	V01 EMB 70 8238 VN1L 90-3/8" Collar	US26D	SA
2	Interchangeable Core	I/CK-7	626	BE
2	Const. Core	7190224	Green	BE
1	Balance of hardware	Existing to remain		OT

Set: 12.0

Doors: C115-2

Description: Existing add 8237

1	Classroom Lock	70 8237 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Balance of hardware	Existing to remain		OT

Set: 13.0

Doors: N126-1

Description: Existing add 8238 and 351 closer w/ HO arm

1	Classroom Security Escutcheon Kit	IS V01 8238 VN1L LH	US26D	SA
2	Interchangeable Core	I/CK-7	626	BE
2	Const. Core	7190224	Green	BE
1	Surface Closer	TB 351 H	EN	SA
1	Balance of hardware	Existing to remain		OT

Set: 14.0

Doors: A118-1, A118-2, A202-1, A203-1, A205-1, A206-1, A208-1, A213-1, A219-1, A220-1, B101-1, D128-1, D143-1, D143-2, E201-1, E206-1, E207-1, E208-1, E209-1, E210-1, E213-1, E214-1, E216-1, E217-1, E218-1, E219-1, E220-1, E221-1, F213-1, F215-1, F216-1, F224-1, F225-1, G112-1, G112-2, G115-1, G115-2, G116-1, N111-1, N113-1, N116-1, N118-2, N203-1, N204-1, N214-1, N215-1, N216-1, N224-1, T133-1, T134-1, U109-1, U113-1, U115-1, U206-1, U207-1, U208-1, U210-1, U211-1, U213-1, U215-1, U216-1, U218-1, U219-1, U220-1, U221-1, U223-1, U224-1, U225-1, U227-1, X204-1, X204-2, X209-1, X209-2, X211-1, X211-2, Y109-1, Y116-1, Y116-2, Y202-1, Y203-1, Y206-1, Y207-1, Y224-1, Y224-2, B126-1, B126-2

Description: Existing add parallel HO closer arm

1	Parallel Hold Open Arm	25-PSH	EN	SA
1	Balance of hardware	Existing to remain		OT

Set: 15.0

Doors: B114-1, B117-1, B118-1, B119-1, B120-1, B122-1, D121-1, E106-1, E107-1, E108-1, E109-1, E110-1, E111-1, E114-1, E115-1, E116-1, E119-1, E120-1, E121-1, E123-1, F104-1, F105-1, F106-1, F116-1, F117-1, F118-1, F119-1, F120-1, F121-1, F122-1, F206-1, F207-1, F212-1, F214-1, F220-1, F221-1, F222-1, G105-1, G109-1, K102-1, L209-1, L219-1, L220-1, N118-1, N120-1, N212-1, N213-1, N218-1, N219-1, N220-1, N222-1, U106-1, U107-1, U110-1, U119-1, U120-1, U121-1, U126-1, U129-1, U131-1, U202-1, U228-1, Y102-1, Y103-1, Y215-1, G103-2, G103-1
Description: Existing add hold open closer arm

1	Regular Hold Open Arm	25-H	EN	SA
1	Balance of hardware	Existing to remain		OT

Set: 16.0

Doors: B115-1
Description: Existing add 8816 exit device and parallel HO closer arm

1	Rim Exit Sec CR x SPAR#NC-E11	LD 19 43 49 70 8816 ETL	US32D	SA
2	Interchangeable Core	I/CK-7	626	BE
2	Const. Core	7190224	Green	BE
1	Parallel Hold Open Arm	25-PSH	EN	SA
1	Balance of hardware	Existing to remain		OT

Set: 17.0

Doors: G120-1, G120-2, G122-1
Description: New Kitchen Locker/RR

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Classroom Lock	70 8237 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Surface Closer	TB 351 PSH	EN	SA
1	Gasketing	2891APK (head & jambs)		PE

Set: 18.0

Doors: J121-1, J121-4, L200-1, L200-2
Description: Existing add 8816 exit device w/ 704 trim and parallel HO closer arm

1	Rim Exit Device	LD 19 43 49 8816 ETL	US32D	SA
1	Exit Device Trim	70 704-ETL	US26D	SA
2	Interchangeable Core	I/CK-7	626	BE
2	Const. Core	7190224	Green	BE
2	Parallel Hold Open Arm	25-PSH	EN	SA
1	Balance of hardware	Existing to remain		OT

Set: 19.0

Doors: J121-2, J121-3
Description: Existing add 70-704 trim only pair

2	Exit Device Trim	70 704-ETL	US26D	SA
2	Interchangeable Core	I/CK-7	626	BE
2	Const. Core	7190224	Green	BE
1	Balance of hardware	Existing to remain		OT

Set: 20.0

Doors: S107-3
Description: Existing add 70-04 trim only

1	Exit Device Trim	70 704-ETL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Balance of hardware	Existing to remain		OT

Set: 21.0

Doors: L200-3
Description: Existing add 70-704 trim and parallel HO closer arm

1	Exit Device Trim	70 704-ETL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Parallel Hold Open Arm	25-PSH	EN	SA
1	Balance of hardware	Existing to remain		OT

Set: 22.0

Doors: S107-1, S107-2, S107-4, W101-1, W101-2, W101-3, W101-4, W101-5, W101-6, X101-1
Description: Existing add 8816 exit and 704 trim

1	Rim Exit Device	LD 19 43 49 8816 ETL	US32D	SA
1	Exit Device Trim	70 704-ETL	US26D	SA
2	Interchangeable Core	I/CK-7	626	BE
2	Const. Core	7190224	Green	BE
1	Balance of hardware	Existing to remain		OT

Set: 23.0

Doors: E102-2, E112-1, F111-1, K109-1, L131-1, L161-1, L161-2, L167-1, L167-2, L171-1
Description: Existing, remove wall MHOs and add floor MHOs

2	Electromagnetic Holder	980M 24VAC	689	RF

1	Power Supply	Provided by security		SU
1	Balance of hardware	Existing to remain		OT

Notes: Remove existing wall mounted magnetic hold opens.

Set: 24.0

Doors: M101-1, C101-2

Description: Add 2N station

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1	2N Station	2N		OT
1	Power Supply	Provided by security		SU
1	Balance of hardware	Existing to remain		OT

Notes: New 2N station

Set: 26.0

Doors: A117-1, A128-1

Description: New passage exit device fire rated

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Rim Exit Device, Passage	12 19 TB 43 8815 ETL	US32D	SA
1	Door Closer	TB 351 O/P9 (type as required)	EN	SA
1	Door Stop	481H	US26D	RO
1	Gasketing	2891APK (head & jambs)		PE

Set: 27.0

Doors: A129-2

Description: **Pr Ext - ASF - Exit Device- SN200/DT - KR Mullion - Closer w/Stop Arm -Access Control

1	Continuous Hinge	CFM SLF-HD1 x Dr. Ht.		PE
1	Continuous Hinge	CFM SLF-HD1 PT x Dr. Ht.		PE
1	Electric Power Transfer	EL-CEPT	630	SU
1	Mullion	KR822 (FLK as req)	600	PR
2	Stabilizer	ST989	Dull Black	PR
1	Spacer	MCS822	689	PR
1	Rim Exit xSPAR04867/NC-E11/NC-E35+-	19 TB 43 70 56-SN200-8504 862	US32D	SA
1	Rim Exit SPAR NC-E11	LD 19 TB 43 8510 862	US32D	SA
1	Rim Cylinder	70 34 X #90 - 1/2	US32D	SA

2	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
2	Kit	581-1/ 581-2 as required	EN	SA
2	Surface Closer	TB 351 PS	EN	SA
2	Sweep IDF/MDF/Alum	18061CNB x Dr. Width		PE
1	Threshold	2005AT MSES25SS X Opening Width		PE
1	Perimeter Seal	By door mfgr		OT
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-C***P (length as req'd)		MK
2	Door Position Switch	By Security.		OT
1	Power Supply	Provided by security		SU

Notes: Operation: Doors normally closed and locked. Valid card at the card reader retracts the latch on the active leaf for entry. Free egress at all times. Door status monitored. Confirm specified hardware is compatible with aluminum door manufacturer.

Set: 28.0

Doors: A129-1

Description: **Pr Ext - ASF - Exit Device- NL/DT - KR Mullion - Closer w/Stop Arm

2	Continuous Hinge	CFM SLF-HD1 x Dr. Ht.		PE
1	Mullion	KR822 (FLK as req)	600	PR
1	Stabilizer	ST989	Dull Black	PR
1	Spacer	MCS822	689	PR
1	Rim Exit Device, Storeroom	LD 19 TB 43 70 8504 862	US32D	SA
1	Rim Exit SPAR NC-E11	LD 19 TB 43 8510 862	US32D	SA
1	Sreel Mullion Lock	70 34 x 1KB-3	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
2	Kit	581-1/ 581-2 as required	EN	SA
2	Surface Closer	TB 351 PS	EN	SA
2	Sweep IDF/MDF/Alum	18061CNB x Dr. Width		PE
1	Perimeter Seal	By door mfgr		OT

Notes:

Set: 29.0

Doors: G120-3

Description: **Sgl - ExT -HM - Exit- SN200 - Closer /Stop- Access Control

1	Continuous Hinge	CFM HD1 PT x Dr. Ht.		PE

1	Electric Power Transfer	EL-CEPT	630	SU
1	Rim Exit x SPAR04867/NC-E11	19 LD TB 43 70 56-SN200-8804	US32D	SA
1	Vandal Resistant Trim	826	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Surface Closer	TB 351 PS	EN	SA
1	Gasketing	2891APK (head & jambs)		PE
1	Rain Guard	346C x Frame Width		PE
1	Sweep	345ANB x Dr. Width		PE
1	Threshold	2005AT MSES25SS X Opening Width		PE
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-C***P (length as req'd)		MK
1	Door Position Switch	By Security.		OT
1	Power Supply	Provided by security		SU

Notes: Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times.

Set: 30.0

Doors: K110-1

Description: **Pr - ExT -HM - Exit- SN200/EO - Closer /Stop- Access Control

1	Continuous Hinge	CFM HD1 x Dr. Ht.		PE
1	Continuous Hinge	CFM HD1 PT x Dr. Ht.		PE
1	Power Transfer	EL-CEPT	630	SU
1	Rim Exit x SPAR04867/NC-E11	19 LD TB 43 70 56-SN200-8804	US32D	SA
1	Rim Exit SPAR NC-E11	LD 19 TB 43 8810 MAL	US32D	SA
1	Vandal Resistant Trim	826	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
2	Surface Closer	TB 351 PS	EN	SA
1	Gasketing	2891APK (head & jambs)		PE
1	Rain Guard	346C x Frame Width		PE
2	Sweep	345ANB x Dr. Width		PE
1	Threshold	2005AT MSES25SS X Opening Width		PE
2	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-C***P (length as req'd)		MK
2	Door Position Switch	By Security.		OT
1	Power Supply	Provided by security		SU

Notes: Doors are normally closed and secure. Presentation of valid credential will allow entry by

pull. Upon loss of power, doors will remain secure. Free egress at all times.

Set: 30.1

Doors: K110-2

Description: **Pr - ExT -HM - Exit- EO - Closer /Stop

2	Continuous Hinge	CFM HD1 x Dr. Ht.		PE
1	Rim Exit Storeroom	19 LD TB 43 70 8804	US32D	SA
1	Rim Exit SPAR NC-E11	LD 19 TB 43 8810 MAL	US32D	SA
1	Vandal Resistant Trim	826	US32D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
2	Surface Closer	TB 351 PS	EN	SA
1	Gasketing	2891APK (head & jambs)		PE
1	Rain Guard	346C x Frame Width		PE
2	Sweep	345ANB x Dr. Width		PE
1	Threshold	2005AT MSES25SS X Opening Width		PE
2	Door Position Switch	By Security.		OT

Notes: Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times.

Set: 31.0

Doors: A135-1, AS101-1, AS105-1, AS105-2

Description: **Sgl - Ext- Mech/Storage/Fire Riser - Closer w/Stop Arm

1	Continuous Hinge	CFM HD1 x Dr. Ht.		PE
1	Storeroom/Closet Lock	70 8204 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Surface Closer	TB 351 PS	EN	SA
1	Gasketing	2891APK (head & jambs)		PE
1	Rain Guard	346C x Frame Width		PE
1	Sweep	345ANB x Dr. Width		PE
1	Threshold	2005AT MSES25SS X Opening Width		PE
1	Door Position Switch	By Security.		OT

Set: 32.0

Doors: A134-1, D134-2

Description: **Pr Ext - Storeroom/Mech-(Classroom Lock) Closer/HO - Armor

2	Continuous Hinge	CFM HD1 x Dr. Ht.		PE
1	Surface Bolt	580-12 @ top only	US26D	RO
1	Classroom Lock	70 8237 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
2	Surface Closer	TB 351 PSH	EN	SA
2	Armor Plate	K1050 36" CSK BEV	US32D	RO
1	Astragal Set (2)	18061CNB x Dr. Ht		PE
1	Gasketing	2891APK (head & jambs)		PE
2	Sweep	345ANB x Dr. Width		PE
1	Threshold	2005AT MSES25SS X Opening Width		PE

Set: 33.0

Doors: A130-1, A130-2, A132-1, A132-2

Description: Sgl - Exit Device-Security CL - Closer

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Rim Exit Sec CR x SPAR#NC-E11	12 19 LD 43 49 70 8816 ETL	US32D	SA
2	Interchangeable Core	I/CK-7	626	BE
2	Const. Core	7190224	Green	BE
1	Surface Closer	TB 351 PS	EN	SA
1	Door Stop	481H	US26D	RO
1	Gasketing	2891APK (head & jambs)		PE

Set: 34.0

Doors: L128-1, L101-1

Description: Add 351 closer with Hold Open

1	Surface Closer	TB 351 PS	EN	SA

Set: 35.0

Doors: A131-1, A133-1, D125-1, D125-2, P116-1

Description: **Sgl - Storeroom

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Storeroom/Closet Lock	70 8204 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Stop	481H	US26D	RO
3	Silencer	608		RO

Set: 36.0

Doors: G125-1
Description: **Sgl - Storeroom - Seals

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Storeroom/Closet Lock	70 8204 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Stop	481H	US26D	RO
1	Gasketing	2891APK (head & jambs)		PE

Set: 37.0

Doors: B129-1, B130-1, K111-1, P106-1, P106-2, P115-1, G127-1
Description: **Sgl - Storeroom -Closer

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Storeroom/Closet Lock	70 8204 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Closer	TB 351 O/P9 (type as required)	EN	SA
1	Door Stop	481H	US26D	RO
3	Silencer	608		RO

Set: 38.0

Doors: D148A-1
Description: **Sgl - Storeroom - Closer - Gasket - Sweep MDF/IDF

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Storeroom/Closet Lock	70 8204 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Closer	TB 351 O/P9 (type as required)	EN	SA
1	Door Stop	481H	US26D	RO
1	Gasketing	2891APK (head & jambs)		PE
1	Sweep	345ANB x Dr. Width		PE
3	Silencer	608		RO

Set: 39.0

Doors: D127-1, P107-1, P114-1
Description: **Sgl - Office, Conf, Work, Sat Admin Offices, Lounge, Nurse - No Closer

3	Hinge, Full Mortise	TA2714	US26D	MK

1	Classroom Lock	70 8237 LL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Stop	481H	US26D	RO
1	Silencer	608		RO

Set: 40.0

Doors: D121-2, D129-2

Description: **Sgl - Classroom - 8238 - HO

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Classroom Security Intruder Lock	V01 EMB 70 8238 VN1L 90-3/8" Collar	US26D	SA
2	Interchangeable Core	I/CK-7	626	BE
2	Const. Core	7190224	Green	BE
1	Door Closer w/ HO	TB 351 H (inswing)/ PSH (outswing) As Req	EN	SA
1	Door Stop	481H	US26D	RO
3	Silencer	608		RO

Set: 40.1

Doors: K102-1

Description: **Sgl - Classroom - 8238 - HO

3	Hinge Heavyweight	T4A3786	US26D	MK
1	Classroom Security Intruder Lock	V01 EMB 70 8238 VN1L 90-3/8" Collar	US26D	SA
2	Interchangeable Core	I/CK-7	626	BE
2	Const. Core	7190224	Green	BE
1	Door Closer w/ HO	TB 351 H (inswing)/ PSH (outswing) As Req	EN	SA
1	Door Stop	481H	US26D	RO
3	Silencer	608		RO

Set: 41.0

Doors: P110-1, P111-1, P112-1, P113-1

Description: **Sgl - 8237 - STC

1	Gasket, threshold, door bottom	By the STC door manufacturer		OT
3	Hinges	By the STC door manufacturer		OT
1	Classroom Lock	31 70 8237 LNL	US26D	SA
1	Interchangeable Core	I/CK-7	626	BE
1	Const. Core	7190224	Green	BE
1	Door Stop	462	US2C	RO

Notes:
Door hardware is specified for design intent. Confirm hardware compatibility and design meets the door manufacturer's approved assembly testing for the STC level indicated.

Set: 42.0

Doors: G120-4, G120-5, G120-6

Description: **OH Coiling Doors - Motorized

2	Interchangeable Core	I/CK-7	626	BE
2	Const. Core	7190224	Green	BE
2	Mortise Cylinder	70 42	US32D	SA
2	Keyswitch	MK x MKS		SU
1	Balance hardware	by the door manufacturer		OT

Notes: Provide keyswitch on both sides of door.

Set: 43.0

Doors: Gate A, Gate C, Gate D, Gate F, Gate H, Gate W, Gate G1
Description: Gate – Panic

1 Hydraulic Gate Closer & Hinge MAMMOTH-180 LO
1 Rim Exit Device CCSD 19 TB 43 70 8804 US32D SA
1 Vandal Resistant Trim 826 US32D SA
1 Interchangeable Core I/CK-7 626 BE
1 Const. Core 7190224 Green BE

Notes: Balance of hardware by gate manufacturer.

Set: 44.0

Doors: Gate B, Gate V
Description: Gate – Panic with Access Control

1 Hydraulic Gate Closer & Hinge MAMMOTH-180 LO
1 Rim Exit Device CCSD 19 TB 43 70 8804 US32D SA
1 Vandal Resistant Trim 826 US32D SA
1 Interchangeable Core I/CK-7 626 BE
1 Const. Core 7190224 Green BE
1 Electric Strike

9400 HS

Set: 45.0

Doors: Gate J, Gate K, Gate L, Gate M, Gate N, Gate P, Gate P1, Gate Q,Gate R, Gate S, Gate U, Gate Y, Gate Z, D134-1,D135-1, D136-1, D137-1, D138-1, D139-1, D140-1, D141-1
Description: Fence Gate

1 Interchangeable Core I/CK-7
626 BE
1 Cylinder 70
42 US32D SA
1 Const. Core 7190224
Green BE

Notes: Balance of hardware by gate manufacturer.

Set: 46.0

Doors: AS101-2
Description: **OH Coiling Doors - Manual

2	Interchangeable Core	I/CK-7	626	BE
2	Const. Core	7190224	Green	BE
2	Mortise Cylinder	70 42	US32D	SA
1	Balance hardware	by the door manufacturer		OT

Set: 47.0

Doors: G123-1, G124-1
Description: Single – Privacy – With Indicator

3 Hinge TA2714 4-1/2" x 4-1/2"
US26D MK
1 Privacy set w/Indicator V20 8265 VN1L
26D SA
1 Door Closer TB351 H/CPSH (type as required)
EN SA
1 Spacer Kit 581-2
EN SA
1 Door Stop 481H
US26D RO
3 Silencer
608 RO

Set: 48.0

Doors: MISC
Description: **Attic Stock - EVERY CAMPUS

1	Hydraulic Gate Closer & Hinge	MAMMOTH-180-HD	9005	OT
5	Quick Fix Bolts	MAMMOTH-P00006000		OT
5	Mullion Lock	98-2520		SA
5	Mullion Lock	98-2518		SA

5	Classroom Security Intruder Lock Body	8238	US26D	SA
5	8205 thumbturn kit	130KB	26D	SA
50	Interchangeable Core	I/CK-7	626	BE
50	Key Blanks	Best "A" Keyway		BE
12	Regular Hold Open Arm	25-H	EN	SA
12	Parallel Hold Open Arm	25-PSH	EN	SA
4	Electromagnetic Holder	994M 24VAC	689	RF
5	994M Magnetic Parts	Door Armature 994510M	689	RF
5	994M Magnetic Parts	Screw & Backplate 998300	689	RF
5	994M Magnetic Parts	Swivel Armature 900-3	689	RF
5	994M Magnetic Parts	Magnet Assembly 998369-3V	689	RF
5	994M Magnetic Parts	Wall Cover 998315M	689	RF
4	SN200 Reader	52 6027 (Exit / Lock)	26D	SA

Notes: All attic stock ships direct to
Director of Technical Services
Cy Fair ISD Lockshop
11430 Perry Road
Houston, Texas 77064

END OF SECTION 087100

SECTION 08 80 00

GLAZING

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Exterior glass and aluminum framing systems and storefront systems.
   02 Aluminum glass entry doors.
   03 Glazing of plastic laminate doors.
   04 Glazing of hollow metal doors.
   05 Fire-rated glazing

C. Related Work:
   01 Section 08 11 13 – Hollow Metal Doors and Frames
   02 Section 08 14 23.16 – Plastic Laminate Faced Wood Doors
   03 Section 08 71 00 – Door Hardware
   04 Section 08 34 73 – Sound Control Door Assemblies
   05 Section 08 87 23 – Safety and Security Films

1.2 SUBMITTALS

A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01 Include recommended cleaning products and instructions for use.
   02 Where applicable, provide recommended maintenance schedules and procedures.

F. Design Calculations: Provide engineering calculations, signed and sealed by a Texas Registered Structural Engineer, which demonstrate the design, assemblies and anchoring of proposed glazing assemblies meet or exceed the stated wind load requirements for all conditions.

G. Samples: Show manufacturer's full range of colors:
   01 Samples of each type of glass (12" x 12" minimum).
   02 In place sample of sealant at frame perimeter for Architect's approval. Architect shall select samples for review from manufacturer's full color line.
   03 Obtain hardware templates from finish hardware supplier.
   04 Samples of framing finish for approval and fastener types.
   05 Sample of proposed sub-sill flashing; minimum 12" in length, complete with end dams on both ends.

H. Mock-up:
   01 In conjunction with mock-up wall required for masonry and back-up walls, provide a mock-up window incorporated into the masonry mock-up.
   02 Mock-up window shall be minimum 16" x 16" and shall include head, jamb, sill framing members and sub-sill flashing. Glass is not required.
   03 Construct in such a way that all fastening methods are viewable.
   04 Perimeter of window shall be sealed continuous.

I. For warranties longer than one (1) year, submit a sample of the warranty proposed to be furnished.

J. Certificates: Submit certificates from respective manufacturers attesting that glass and glazing materials furnished for project comply with requirements.

K. Compatibility and Adhesion Test Report: Submit statement from sealant manufacturer indicting that glass and glazing materials have been tested for compatibility and adhesion with glazing sealants and interpreting test results relative to material performance, including recommendations for primers and substrate preparation needed to obtain adhesion.

1.3 REFERENCES

A. American National Standards Institute (ANSI):
   01 ANSI Z97.1 – American National Standard for Glazing Materials Used in Buildings – Safety Performance Specifications and Methods of Test.

B. American Society for Testing and Materials (ASTM):
   01 ASTM C162 – Standard Terminology for Glass and Glass Products.
   02 ASTM E 774 – Standard Specification for Sealed Insulating Glass Units.
   03 ASTM C920 Standard Specification for Elastomeric Joint Sealants.
   04 ASTM C1036 – Standard Specifications for Flat Glass.

05 ASTM C1048 – Standard Specification for Heat-Treated Flat Glass – Kind HS, Kind FT Coated and Uncoated Glass.
06 ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Glass.
07 ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Door
08 ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference
09 ASTM E1300 - Standard Practice for Determining the Minimum Thickness and Type of Glass Required to Resist a Specified Load.
10 ASTM E2010-01 – Standard Test Methods for Positive Pressure Fire Tests for Window Assemblies.
11 ASTM E2188 – Standard Test Method for Insulating Glass Unit Performance.
12 ASTM E2189 - Standard Test Method for Testing Resistance to Fogging in Insulating Glass Units.
13 ASTM E2190 – Standard Specification for Insulating Glass Unit Performance and Evaluation.

C. American Architectural Manufacturers Association (AAMA)
01 AAMA 503 – Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems.

D. Federal Specifications:
01 Fed. Spec. DD-G-001403 B.
02 Fed. Spec. TT-S-00230 Sealing Compound: Synthetic Rubber Base and TT-S-00203C.
03 Fed. Spec. TT-S-001657 Sealing Compound: Butyl Rubber Base.
04 Fed. Spec. DD-G-451d.

E. National Fire Protection Association (NFPA):
01 NFPA 80 – Fire Doors and Windows.
02 NFPA 252 – Fire Tests of Door Assemblies.
03 NFPA 257 – Fire Tests of Window Assemblies.

1.4 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts, and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section. Any installer specializing in performing work of this section must have a minimum of three (3) years documented experience.

B. Provide aluminum framing systems, doors, and windows from one source and supplied by a single manufacturer.

C. In addition to complying with pertinent codes and regulations of governmental agencies having jurisdiction, comply with pertinent recommendations contained in:
01 Flat Glass Marketing Association:
a. Glazing Sealing Systems Manual.
b. Glazing Manual.

D. Fire Protective Rated Glass: Each lite shall bear permanent, nonremovable label of UL certifying it for use in tested and rated fire protective assemblies.

E. Fire Protective Glazing Products for Door Assemblies: Products identical to those tested per ASTM E2074-00, classified and labeled by UL acceptable to authorities having jurisdiction.

F. Field Testing:
   01 Water penetration and air infiltration field testing shall be performed by a third-party building envelope testing consultant hired by Contractor.
   02 Testing of three (3) different locations shall be performed at the following intervals of the glazing installation: 10% complete, 50% complete and 90% complete.
   03 Specific test locations shall be determined on the day of the testing; and may include both first and second floor locations.
   04 Refer to Part 3 – Execution for additional information.
   05 Owner's and Architect's Field Representative to be present at time of testing.
   06 Provide written report to Owner and Architect within seventy-two (72) hours of test.

G. Manufacturer's Field Representation:
   01 The manufacturer shall provide on-site observation by a qualified technical representative familiar with the window systems being installed at the following times:
      a. Commencement of Window Installation: Representative shall observe the complete installation of the first window being installed.
      b. Field Testing: Representative shall be present for all field testing of windows and glazing.
      c. Periodic site observation visits during window / glazing installation at the following intervals of installation completeness: 25%, 50%, 75% and 100%.
   02 Within seventy-two (72) hours after each site observation visit, the manufacturer's representative shall furnish an observation report documenting activities, direction to the installer, and other pertinent information.

1.5 WARRANTY

A. Submit a written warranty, executed by the entrance manufacturer, agreeing to repair or replace units that fail in workmanship during warranty period. Failures include, but are not limited to:
   01 Structural and performance failures, including excessive deflection, excessive leakage, air infiltration beyond specified requirements.
   02 Faulty operation of hardware directly related to items listed above.
   03 Deterioration of metals, metal finishes, and other materials beyond normal weathering.

B. Manufacturer's warranty period shall be as follows:
   01 Coated-Glass Products: Furnish 10-year written warranty from substantial completion date, made out to Owner and signed by coated-glass manufacturer agreeing to furnish replacements for those coated-glass units that deteriorates within the specified warranty period.

02 Laminated Glass: Furnish a 5-year written warranty from substantial completion date, made out to the Owner and signed by the laminated-glass manufacturer agreeing to furnish replacements for laminated-glass units that deteriorates within the specified warranty period.

03 Insulating Glass: Furnish a 10-year written warranty from substantial completion date, made out to the Owner and signed by the insulating-glass manufacturer agreeing to furnish replacements for insulating-glass units that deteriorates within the specified warranty period.

04 Laminated Security Glass: Furnish a 5-year written warranty from substantial completion date, made out to the Owner and signed by the laminated security glass manufacturer agreeing to furnish replacements for laminated security glass units that deteriorates within the specified warranty period.

05 Insulating Security Glass: Furnish a 10-year written warranty from substantial completion date, made out to the Owner and signed by the insulated security glass manufacturer agreeing to furnish replacements for insulated security glass units that deteriorates within the specified warranty period.

06 Fire-Rated Glazing: Furnish a 5-year written warranty from substantial completion date, made out to the Owner and signed by the fire-rated glass manufacturer agreeing to furnish replacements for fire-rated glass that deteriorates within the specified warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Glass: The following manufacturers are acceptable to provide glass products in accordance with the specified requirements:

01 Clear and Tinted Float Glass:

a. AFG Industries
b. Ford Glass Division
c. Guardian Glass
d. LOF Glass, Inc.
e. Vitro Architectural Glass
f. Saint-Gobain/Euroglass
g. Consolidated Glass Holdings, Global Security Glazing and Dlubak Specialty Glass Corporation (Security Glazing only).
h. TGP Architectural (Fire-rated glazing only)

02 Heat Treated Glass:

a. Cardinal IG
b. Environmental Glass Products
c. Falconer Glass Industries
d. Ford Glass Division
e. Guardian Industries, Corp.
f. Hordis Brothers, Inc.
g. LOF Glass, Inc.
h. Saint-Gobain/Euroglass
i. Spectrum Glass Products Div., H.H. Robertson, Co.

03 Fire-rated Glass:

a. Fireglass
b. Kawneer

c. Satifirst
d. Technical Glass Products (TGP)

B. Aluminum Framing System and Doors: The basis of design for specified materials / systems / assemblies are products as manufactured by Oldcastle Building Envelope.

C. Other acceptable aluminum framing system and door manufacturers:
01 EFCO
02 Kawneer North America
03 Atlas Architectural Metals
04 TRACO
05 TruLite Aluminum & Glass Solutions
06 Wausau

2.2 PERFORMANCE SPECIFICATIONS

A. Requirements apply simultaneously through the most adverse conditions of each exterior application.
01 Thermal Movement at Exterior Systems: Provide for noiseless expansion and contraction of all materials and assemblies due to temperature changes in a range between 10°F and 180°F, without detriment to appearance or performance.
02 Water Infiltration at Exterior Systems: Drain water entering at joints and condensation occurring within the wall construction to the exterior face of the wall. Allow no uncontrolled water other than condensation on the interior face of the wall.
03 Air Filtration at Exterior Locations: Limit air leakage to maximum of 0.06 cfm per square foot of wall projected areas (storefront at 8 lbs./sq.ft).

2.3 GENERAL MATERIALS

A. Aluminum:
01 ASTM B221, alloy 6063-T5 for extrusions; ASTM B209, alloy 5005-H16 for sheets; or other alloys and temper recommended by manufacturer appropriate for specified finish.
02 Provide minimum thickness of 0.125 inch for framing members and 0.050 inch for glazing stops and similar components.

B. Internal Reinforcing:
01 ASTM A36 for carbon steel; or ASTM B308 for structural aluminum.
02 Shapes and sizes to suit installation.
03 Shop coat steel components after fabrication with alkyd type zinc chromate primer complying with Federal Spec. TT-P-645.
04 Provide steel reinforcing in aluminum framing as required to achieve specified wind load resistance.

C. Inserts and Anchorage Devices:
01 Manufacturer's standard formed or fabricated assemblies, steel or aluminum, of shapes, plates, bars or tubes.
02 Hot-dip galvanize steel assemblies after fabrication; comply with ASTM A123, 2.0 ounce minimum coating.
03 Provide all anchoring angles, plates, fasteners and accessories required for secure attachment to adjacent work.

D. Fasteners:

01 Non-magnetic stainless steel or cadmium plated steel coated with yellow or silver iridescence plating, compatible with materials being fastened.

02 Provide series 300 stainless steel for exposed locations.

03 Provide cadmium plated steel with 0.0005 inch plating thickness and color chromate coated for concealed locations.

04 Provide nuts or washers of design having the means to prevent disengagement; deforming of fastener threads is not acceptable.

05 Provide concealed fasteners wherever possible.

06 For exposed locations, provide countersunk flathead fasteners with finish matching item fastened.

07 All fasteners used to secure the sub-sill flashing and sill frame member shall be bedded in sealant at penetrations through window assembly components. Heads of fasteners at these locations shall be covered with sealant.

E. Sub-Sill Flashing:

01 All exterior glazed systems / window walls / windows shall be furnished with continuous sub-sill flashing, spanning the full width of the rough opening.

02 Sub-sill flashing shall be minimum 0.065” aluminum with integral (turned up) end dams and back dams. Minimum height of dams shall be 1”.

03 Open vertical joint at end dam / back dam junction shall be welded continuous to form a seamless dam component directing any / all trapped water to outside of building. Provide thicker material than specified above if required to meet this requirement.

04 Sub-sill flashing shall extend to the exterior building face / veneer and turn down 3/4".

05 All exposed edges shall be ground to eliminate sharp edges and corners. Hemmed edges are acceptable.

06 Finish of sub-sill flashing shall match frame finish.

F. Miscellaneous Materials:

01 Provide material isolators at all dissimilar metals in contact with aluminum framing components.

02 Where indicated on the Drawings provide minimum 0.080” aluminum extrusions or break metal between non-contiguous framing components (i.e. segmented radius walls, column wraps, etc.). Fabricate as required for concealed fastening.

03 Snap on glass stops shall be beveled type – square stops are to be fastened (door window stops).

G. Glazing Materials at Aluminum Framing:

01 Glazing Gaskets: Extruded neoprene conforming to ASTM C502 (color “black”), sized to fit the frame.

02 Sealant: Comply with Federal Spec. TT-S-00230.

03 Compatibility: Select glazing sealants and tapes of proven compatibility with other materials with which they will come into contact, including glass products, seals of insulating glass units, and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.

04 Suitability: Comply with recommendations of sealant and glass manufacturers for selection of glazing sealants and tapes which have performance characteristics suitable for applications indicated and conditions at the time of installation.

H. Glazing Materials at Hollow Metal Frames:
01 General: Use glazing compound and preformed glazing sealants approved for the application, except as otherwise specified, conforming to Glazing Materials portion of the FGMA Glazing Manual.
02 Sealant:
a. One part acrylic polymer sealant conforming to Federal Spec. TT-S-00230 or silicone, Federal Spec. TT-S-0023-C. Use for glazing of all fixed glass. Include primer as recommended by manufacturer.
b. Color: Shall as selected by Architect from manufacturer's full range.
c. All sealants shall be compatible with adjacent material per manufacturer's recommendations and instructions.
03 Setting Blocks: Hard rubber or clean grain softwood.
04 Back-up Material: Foamed polyethylene or polystyrene rod stock; sizes as required by joint condition, and compatible with sealant.
05 Glazing Tape: DAP #1202 or as approved.
06 Glazing Gaskets: Extruded neoprene, free of porosity, surface defects, dimensional irregularities, and conforming to physical properties of ASTM C502.
07 Use of metal sash putty will not be permitted, but compound conforming to Federal Spec. T-G-410 will be permitted. The use of non-skinning compounds, non-resilient type preformed sealers and preformed impregnated type gaskets will not be permitted.
08 Compatibility: Select glazing sealants and tapes of proven compatibility with other materials with which they will come into contact, including glass products, seals of insulating glass units, and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.
09 Suitability: Comply with recommendations of sealant and glass manufacturers for selection of glazing sealants and tapes which have performance characteristics suitable for applications indicated and conditions at the time of installation.

2.4 GLASS MATERIALS

A. Glass Type G1: Insulated Fire Rated Glass:
01 Not Used

B. Glass Type G2: Fully Tempered Clear Glass:
01 1/4" thick.
02 Complying with ASTM C1048, Type 1, Class 1 (clear), Quality 3, Kind FT.
03 Clear.
04 Use at all non-fire-rated interior glazing unless indicated otherwise.

C. Glass Type G3: Fire-Rated Safety Wired Glass:
01 Not Used

D. Glass Type G4: Insulated Glass:

01 Overall thickness of 1” comprised of 2 lites of 1/4” glass separated by a 1/2” air space.
02 Air space to be dual sealed and meeting the certification requirements of the IGCC for a CBA rating.
03 Exterior / Outboard Lite shall be:
a. Low-E, Fully Tempered Tinted Glass.
b. Complying with ASTM C1048, Type I, Class 2 (tinted), Quality 3, Kind FT.
c. Solarban 70 on Solarbronze low-E coating by Vitro on the No. 2 Surface.
d. U-Factor:
1. Winter Nighttime: .28
2. Winter Argon: .24
e. Solar Heat Gain Coefficient: .20
f. Visible Light Transmittance: 39%
04 Interior / Inboard Lite shall be:
a. Fully tempered glass.
b. Complying with ASTM C1048, Type 1, Class 1 (clear), Quality 3, Kind FT.
c. Clear.

E. Glass Type G5: Insulated Spandrel Glass:
01 Overall thickness of 1” comprised of 2 lites of 1/4” glass separated by a 1/2” air space.
02 Air space to be dual sealed and meeting the certification requirements of the IGCC for a CBA rating.
03 Exterior / Outboard Lite shall be:
a. Low-E, Fully Tempered Tinted Glass.
b. Complying with ASTM C1048, Type I, Class 2 (tinted), Quality 3, Kind FT.
c. Solarban 70 on Solarbronze low-E coating by Vitro on the No. 2 Surface.
d. U-Factor:
1. Winter Nighttime: .28
2. Winter Argon: .24
e. Solar Heat Gain Coefficient: .20
f. Visible Light Transmittance: 39%
g. Ceramic Enamel Frit: color as selected by Architect from manufacturer’s full range of available colors / finishes.
04 Interior / Inboard Lite shall be:
a. Fully tempered glass.
b. Complying with ASTM C1048, Type 1, Class 1 (clear), Quality 3, Kind FT.
c. Clear.

F. Glass Type G6: Acoustical Glass:
01 Not Used.
02 Glass lites in sound control door assemblies shall be provided as indicated in Section 08 34 73 – Sound Control Door Assemblies.

G. Glass Type G7: Hurricane Resistant Glass:
01 Not Used

H. Glass Type G8: Hurricane Resistant Spandrel Glass:
01 Not Used

I. Glass Type G9: Spandrel Glass:
   01 Not Used.

J. Glass Type G10: Monolithic Interior Security Glazing (impact-resistant glazing)
   01 Not Used.

K. Glass Type G11: Monolithic Interior Enhanced Security Glazing (impact-resistant glazing)
   01 Overall unit thickness: 9/16”
   02 Childgard-2118 Security Glazing by Global Security Glazing or other CGH Inc. Company
      a. Forced Entry Resistance: ASTM F1233 Class 1.4
      b. Forced Entry Resistance: 5-aa1 rated for a minimum of 16 minutes
      c. Bullet Resistance: HP White-TP 0500.03 Level A
         1. .38 special handgun, 3 shots in an 8” circle, 158 grain lead, 20 feet. Spall with no penetration.
      d. Glass color: Clear
   03 Provide Test Report for ASTM F1233 Class 1.4 by Third Party Independent Laboratory.
   04 Provide Test Report for 5-aa1 by Third Party Independent Laboratory.
   05 Provide Test Report for HP White-TP-0500.03 Level A for bullet resistance.
   06 Childgard glass panel(s) MUST have product stencil/logo number identification 2621Q or 2621B etched on every panel.

L. Glass Type G12: Exterior Security Glazing (impact-resistant glazing)
   01 Overall unit Thickness: 1-1/8”
   02 Single Source Insulating Glass with Childgard Security Glazing by Certified Fabricator of Vitro Architectural Glass.
   03 Exterior Pane: ¼” HS or FT glass, with Solarban 70 on Solarbronze Low-E coating by Vitro on the No. 2 Surface.
   04 Airspace: ½” Black aluminum spacer.
   05 Interior Pane: Childgard Security Glazing by Global Security Glazing or other CGH Inc. Company.
      a. Forced Entry Resistance: ASTM F1233 Class 1.3
      b. Forced Entry Resistance: 5-aa1 rated for a minimum of 10 minutes.
      c. Glass color: Clear
      d. U-Factor:
         1. Winter Nighttime: .28
         2. Winter Argon: .24
      e. Solar Heat Gain Coefficient: .20
      f. Visible Light Transmittance: 39%
   06 Provide Certification for Fabrication by Vitro Architectural Glass
   07 Provide Test Report for ASTM F1233 Class 1.3 by Third Party Independent Laboratory.
   08 Provide Test Report for 5 – aal by Third party Independent Laboratory.
   09 Childgard glass panel(s) MUST have product stencil/logo number identification 2621Q or 2621B etched on every panel.

M. Glass Type G13: Laminated Glass
   01 Not Used.

N. Glass Type G14: 120-minute fire-rated glass
   01 Design of glass materials for fire rated glass assemblies is based on SaftiFirst SuperLite II-XLB 120 minute fire resistive glazing with hose stream
   02 Glass Make-Up: Comprised of an inboard and outboard lite of clear tempered glass with a clear, fire resistive intumescent interlayer in between.
   03 Glass thickness: 2-5/8”
   04 Glass weight: Approximately 23.40 lbs/sf
   05 Appearance: Must be tint-free, optically clear fire rated glazing.
   06 Fire Rating: Must be fire rated to 120 minutes with hose stream and meet ASTM E-119 and ANSI/UL263.
   07 Impact Safety Resistance: CPSC 16 CFR 1201 Cat. I & II and ANSI Z97.1 Class A.
   08 Performance: Glass must be rated to stop fire from either direction and must meet all testing requirements including the required hose-stream test.
   09 Glazing accessories to be as recommended by manufacturer.
      a. Glazing with EPDM tape or other listed flame-resistant gasket material and calcium silicate setting blocks.
   10 Each piece of fire-rated glazing material shall be labeled with a permanent logo to include name of product, manufacturer, testing laboratory, fire rating period and safety glazing standards.

O. Glass Type G15: 90-minute fire-rated glass
   01 Design of glass materials for fire rated glass assemblies is based on SaftiFirst SuperLite II-XL 90 minute fire resistive glazing with hose stream
   02 Glass Make-Up: Comprised of an inboard and outboard lite of clear tempered glass with a clear, fire resistive intumescent interlayer in between.
   03 Glass thickness: 1-3/4”
   04 Glass weight: Approximately 12 lbs/sf
   05 Dimensions: no larger than 100 sq. in.
   06 Sound Transmission Class: Must provide minimum STC 40.
   07 Appearance: Must be tint-free, optically clear fire rated glazing.
   08 Fire Rating: Must be fire rated to 90 minutes with hose stream and meet ASTM E-119.
   09 Impact Safety Resistance: CPSC 16 CFR 1201 Cat. I & II and ANSI Z97.1 Class A.
   10 Performance: Glass must be rated to stop fire from either direction and must meet all testing requirements including the required hose-stream test.
   11 Glazing accessories to be as recommended by manufacturer.
      a. Glazing with EPDM tape or other listed flame-resistant gasket material and calcium silicate setting blocks.
   12 Each piece of fire-rated glazing material shall be labeled with a permanent logo to include name of product, manufacturer, testing laboratory, fire rating period and safety glazing standards.

P. IR: Impact resistant (safety & security) film: Refence section 08 87 23.

2.5 ALUMINUM STOREFRONT DOORS

A. Aluminum Entrance Doors: design is based on Oldcastle “Rugged” WS Wide Stile door unit assembly.
   01 Nominal depth: 2”, fabricated with 0.188” minimum thickness aluminum at all tubular sections.
   02 Vertical Stiles: 5”.
   03 Top Rail: 8”
   04 Bottom and intermediate Rails: 10”.
   05 Standard Structural Shapes, Rolled or Extruded Aluminum: Alloy 6061-T6.
   06 Connections: Provide bolted and welded connections, fit to a hairline joint.
   07 Provide reinforcing at bolted attachments. Tapped aluminum is not permitted.
   08 Provide concealed screws, nuts, bolts, and anchors, except hardware screws on hinge and closer-arm of door, of non-corrosive metal.
   09 Finish: bronze anodized aluminum to match existing.
   10 Glass in Exterior Doors: Type G4 at all exterior locations unless indicated otherwise.
   11 Use manufacturer’s recommended gaskets for flush glazing (color “black”).
   12 Refer to Section 08 71 00 – Door Hardware for finish hardware requirements. Coordinate with other trades as required.

2.6 EXTERIOR ALUMINUM FRAMING SYSTEMS

A. Aluminum Storefront / Entrance Framing System: Design is based on Oldcastle Reliance Curtain Wall series.
   01 Size: 2-1/2" x 6”, 7-1/4”, and 10-1/8" mullion profile; to accept 1” glazing. Frame depth to be as required for wind loading.
   02 Pressure glazed, front set, exterior loaded; available with butt glazed verticals.
   03 Provide sub-frames at door jambs on entrances as required to accept Rugged WS doors.
   04 Provide mullion reinforcement, if necessary, to achieve structural requirements to meet wind load criteria.
   05 Intermediate horizontal mullions shall be undersized a minimum of 1 inch less depth than perimeter / primary framing member size.
   06 Finish: Bronze anodized aluminum to match existing.
   07 Glass: Type G4 at all exterior locations unless indicated otherwise.
   08 Glass pockets shall be sized to accept glass specified.
   09 Provide continuous, full depth sill flashing with end dams at all sill sections.
   10 **Vertical members shall not exceed 10 feet in length**. Install vertical splice(s) per Manufacturer’s instructions.
   11 Use interior-glazed system at all second floor and higher exterior windows and at locations noted on drawings.
   12 Provide steel reinforcement as required for lateral bracing (wind loading).

2.7 INTERIOR ALUMINUM FRAMING SYSTEMS

A. Aluminum Framed Systems: design is based on Oldcastle FG-2000 Flush Glazed Storefront system:
   01 Size: 1-3/4" x 4-1/2” mullion profile; center set, exterior loaded; to accept up to 3/8’ glazing.

02 Provide mullion reinforcement, if necessary, to achieve structural requirements to meet loading criteria.
03 Finish: Bronze anodized aluminum to match existing.
04 Glass: Type G2 unless indicated otherwise.
05 Glass pockets shall be sized to accept glass specified.
06 For fire-rated glazing (glass type G14), aluminum frames are to be provided by the fire-rated glazing manufacturer.

B. Aluminum Framed Systems: design is based on Oldcastle FG-3000 Flush Glazed Storefront system:
01 Size: 2" x 4-1/2" mullion profile; center set, exterior loaded; to accept up to 9/16" glazing.
02 Provide mullion reinforcement, if necessary, to achieve structural requirements to meet loading criteria.
03 Finish: Clear anodized.
04 Glass: Type G11
05 Glass pockets shall be sized to accept glass specified.

C. Interior Aluminum Entrance Doors: design is based on Oldcastle Series 500 Wide Stile door unit assembly.
01 Nominal depth: 1-3/4", fabricated with 0.125" minimum thickness aluminum at all tubular sections.
02 Vertical Stiles: 5".
03 Top Rail: 8".
04 Bottom and intermedial Rails: 10".
05 Standard Structural Shapes, Rolled or Extruded Aluminum: Alloy 6063-T5.
06 Provide concealed screws, nuts, bolts, and anchors, except hardware screws on hinge and closer-arm of door, of non-corrosive metal.
07 Finish: Bronze anodized aluminum to match existing.
08 Glass: Type G2 at all interior locations unless noted otherwise.
09 Use manufacturer's recommended gaskets for flush glazing (color "black").
10 Refer to Section 08 71 00 – Door Hardware for finish hardware requirements. Coordinate with other trades as required.

2.8 LITE KITS

A. National Guard Products, low-profile lite kit; L-FRA 100 or approved equal.

B. Material: 18 gauge, cold-rolled steel with powder-coated finish.

C. Color: To be selected by architect from full range of standard and optional colors (to include, but not be limited to, metallic and black options).

D. Standard lite kit opening to measure 6 inches by 27 inches unless shown otherwise on drawings.

E. Provide silicone acoustic seal at locations where type G-6 is being used.

2.9 COMMUNICATION DEVICE (SPEAK THRUs)

A. C.R. Laurence, brushed stainless steel 5-inch speak-thru, or similar as provided by QuikServ.

B. Model SST5

C. Glass: Type G11

D. Finish/Color: Brushed Stainless Steel

E. Size: 5-inch (127mm) diameter

F. Provide one (1) at front entrance reception glass.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Thoroughly examine conditions at each and every location under which Work of this Section will be performed.
   01 Verify that each rough opening is the correct size for the framing being installed. Maximum allowable joint at perimeter of framing shall be 5/8". Inform General Contractor of any non-conforming rough openings and do not proceed until unsatisfactory conditions are corrected.
   02 Verify that the sub-sill substrate is continuous, solid, level and at the proper elevation for installation of sub-sill flashing. Sub-sill flashing must be set in a 100% bed of sealant without any voids. Do not proceed until unsatisfactory conditions are corrected.

B. Verify that wood blocking, thru-wall flashing, masonry and other adjacent work is installed as required for the proper installation of aluminum framing prior to proceeding. Inform General Contractor of any non-conforming work and do not proceed until unsatisfactory conditions are corrected.

C. Clean glazing channels, stops, and rabbets to receive the glazing materials, making free from obstructions and deleterious substances which might impair the work.
   01 Remove protective coatings which fail in adhesion or interfere with bond of sealants.
   02 Comply with manufacturer's' instructions for final wiping of surfaces immediately prior to application of primer and glazing compounds or tapes.
   03 Prime surfaces to receive glazing compounds in accordance with manufacturer's recommendations.

3.2 INSTALLATION – ALUMINUM FRAMING

A. Install all aluminum framing in strict accordance with the manufacturer's installation standards and recommendations; firmly anchored for long life under hard use.

B. All exterior sill members shall be installed with continuous aluminum sub-sill flashing.
   01 Set sub-sill flashing in 100% bed of sealant. Carefully clean off excess sealant after sub-sill flashing is set in place.
   02 All fasteners used to anchor sub-sill flashing shall be completely bedded in sealant prior to installation of sill framing.

03 All fasteners securing sill framing which penetrates through sub-sill flashing shall be installed through a sealant bed as required to maintain the waterproof integrity of the sub-sill flashing / sill-framing assembly.

04 Coordinate with dampproofing sub-contractor to install additional thru-wall flashing at base of jambs to lap over / onto aluminum sub-sill flashing – prior to installation of aluminum framing member(s). Coordinate as required.

C. Shim and center framing within rough opening. Maximum sealant joint at perimeter of framing shall be 5/8". Coordinate with other trades to correct rough opening where perimeter joint will exceed 5/8".

D. Erection Tolerances:

01 Maximum Deviation from Vertical: 1/8 inch in any story and 1/4 inch in any 45 foot run.

02 Maximum Deviation from Horizontal: 1/8 inch in any 30 foot run.

03 Maximum Deviation from True Alignment: 1/32 inch from any two abutting units; and horizontal components meeting at a vertical mullion. Allow no edge projections.

04 Maximum Joint Cap: 1/32 inch.

05 Maximum Openings Between Movable Glazing Stop and Adjacent Member: 1/32 inch.

3.3 INSTALLATION – GLASS

A. Inspect each piece of glass immediately prior to start of installation.

01 Do not install items which are improperly sized, have damaged edges, are scratched, abraded, or damaged in any other manner.

02 Do not remove labels from glass until so directed by the Architect.

03 Install glass so distortion waves, if present, run in a horizontal direction.

B. Locate setting blocks at sills one quarter of the width of the glass in from each end of the glass, unless otherwise recommended by the glass manufacturer.

01 Use blocks of proper size to support the glass in accordance with the manufacturer's recommendations.

02 Provide spacers for all glass sizes larger than 50 united inches, to separate glass from stops, except where continuous glazing gaskets or felts are provided.

a. Locate spacers no more than 24 inches apart, and no closer than 12 inches to a corner.

b. Place spacers opposite one another.

c. Make bite of spacer on glass 1/4 inch or more.

C. Set glass in a manner which produces the greatest possible degree of uniformity in appearance.

D. Do not use two different glazing materials in the same joint system, unless the joint use is approved in advance by the Architect.

E. Mask, or otherwise protect surfaces adjacent to installation or sealants.

F. Install all glass, gasket and aluminum framing in strict accordance with manufacturer's printed instructions.

G. Caulk joints continuous at exterior and interior faces of framing and elsewhere as indicated, as required to meet performance specifications using materials specified in Section 07 92 00 – Joint Sealants. Follow sealant manufacturer's printed instructions for the installation of his product.

3.4 INSTALLATION – SECURITY GLAZING

A. Install security glazing with a fixed interior stop when possible. If removable interior stops must be used, secure stops with mechanical fasteners 5'-6" O.C. so that stops cannot be dislodged during impact.

B. At interior glazing applications, install glass on threat (corridor) side.

C. Use a minimum of ½" bite on all edges.

D. Wet glaze glass using Dow 995 structural sealant on the protected side of the glazing. Apply sealant to the interior glazing leg. Take care not to interfere with weep holes during wet glazing application.

E. Install in accordance with proper glazing techniques as set forth in the Glass Association of North America (GANA) Glazing Manual and Sealant Manual 2010 (or most current edition).

F. Install setting blocks not less than four inches long and slightly wider than the glazing at quarter points.

G. Follow manufacturer-recommended clearances to protect all products from excessive pressure or glass-to-metal contact.

H. Refer to Manufacturers Installation Instructions.

3.5 FIELD TESTING

A. Field Tests: Architect shall select curtain wall units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured.
   01 Interior finishes at window recess (i.e. gypsum board, window sill) shall not be installed at window units to be tested.
   02 If interior finishes at window recess have been installed at windows to be tested, they shall be removed by Contractor prior to testing; and then reinstalled at no additional cost to the Owner.

B. Manufacturer's representative shall be present to observe all field tests and retests.

C. Testing:
   01 Testing shall be performed per AAMA 503 by a qualified independent testing agency.
   02 Air Infiltration Tests: Conduct tests in accordance with ASTM E 783.
      a. Allowable air infiltration shall not exceed 1.5 times the amount indicated in the performance requirements or 0.09 cfm/ft2, whichever is greater.
   03 Water Infiltration Tests: Conduct tests in accordance with ASTM E 1105.

a. No uncontrolled water leakage is permitted when tested at a static test pressure of two-thirds the specified water penetration pressure but not less than 8 PSF.

D. Failed Tests:

01 Tests not meeting specified performance requirements and units having deficiencies shall be corrected by the Contractor and the failed window unit / area shall be retested.

02 In addition to retesting the failed window unit / area, an additional two (2) similar window units / areas shall be tested.

03 All retesting and testing caused by a failed test shall be at the expense of the Contractor.

3.6 CLEANING AND PROTECTION

A. Protect glass from breakage after installation by promptly installing streamers or ribbons, suitably attached to the framing and held free from glass. Do not apply warning markings, streamers, ribbons, or other items directly to the glass, except as specifically directed by the Architect.

B. Protect all window framing during and after installation from marring, blemishes, scratches and damage due to incidental adjacent work. If damaged, make all necessary repairs or replacements in accordance with the manufacturer's recommendations and as directed by the Architect.

C. Remove non-permanent labels and clean surfaces. Wash glass on both faces not more than 4 days prior to date scheduled for inspections indicated to establish date of substantial completion in each area of the project. Wash glass by method recommended by glass manufacturer.

END OF SECTION

SECTION 08 87 23

SAFETY AND SECURITY FILMS

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Application of Safety and Security Film on interior-most surfaces of glass as indicated or scheduled on the Drawings and as specified.
   02 Product may be referred to on drawings as IR, IR film or impact-resistant film.

C. Related Work:
   01 Section 08 11 13 – Hollow Metal Doors and Frames
   02 Section 08 14 23.16 – Plastic Laminate Faced Wood Doors
   03 Section 08 71 00 – Door Hardware
   04 Section 08 80 00 – Glazing

1.2 SUBMITTALS

A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, test reports, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.
   04 Provide calculations demonstrating compliance with wind load and other requirements.
   05 Shop Drawings shall be sealed and signed by a Texas Registered Engineer.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01 Include recommended cleaning products and instructions for use.
   02 Where applicable, provide recommended maintenance schedules and procedures.

F. Color / Finish Samples:
   01 Provide two (2) samples of each finish for selection by the Architect.
   02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
   03 Minimum size shall be 2" x 2", but must be large enough to convey attributes of the proposed product.
   04 Provide each type of finished brick to be provided in quantities sufficient to show range of color where applicable.
   05 Samples of brick ties proposed to be furnished.
   06 Samples of full range of actual mortar color selections. Paper or digital samples are not acceptable.
   07 Sample of mortar deflector proposed to be furnished.

G. Sample / Mock-Up Panel: Coordinate with Glazing Contractor and other trades as required to install security film on the glazed frame and glass component on the mock-up panel.
   01 Film shall match thickness used in final installation.
   02 Include structural sealant joint at glass / frame intersection.

H. Verification Sample: two samples of film on glass representing the actual product, color and pattern.

I. Warranty:
   01 Provide one (1) sample of each warranty proposed to be furnished.

J. Close-out requirements:
   01 Provide copy of fifteen (15) year warranty.
   02 Provide certification that installed film meets all specification requirements.
   03 Provide manufacturer's maintenance, cleaning, and replacement instructions.

1.3 REFERENCES

A. American National Standards Institute (ANSI):
   01 ANSI Z97.1 - Safety Glazing Materials Used in Buildings—Safety Performance Specifications and Methods of Test.

B. American Society for Testing Materials (ASTM):
   01 ASTM D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
   02 ASTM D1044 - Test Method for Resistance of Transparent Plastics to Surface Abrasion."
   03 ASTM D2582 – Standard Test Method for Puncture-Propagation Tear Resistance of Plastic Film and Thin Sheeting
   04 ASTM D4830 – Standard Test Methods for Characterizing Thermoplastic Fabrics Used in Roofing and Waterproofing.

05 ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
06 ASTM E308 – Standard Recommended Practice for Spectrophotometry and Description of Color in CIE 1931 System.
07 ASTM E903 - Test Method for Solar Absorbance, Reflectance, and Transmittance of Materials Using Integrating Spheres.
08 ASTM E1996 – Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.
09 ASTM F3561 – Standard Test Method for Forced-Entry-Resistance of Fenestration Systems After Simulated Active Shooter Attack
10 ASTM G26 – Standard Practice for Performing Accelerated Outdoor Weatherizing for Non-metallic Materials Using Concentrated Natural Sunlight.
11 ASTM G90 – Standard Practice for Performing Accelerated Outdoor Weatherizing for Non-metallic Materials Using Concentrated Natural Sunlight.

C. Consumer Product Safety Commission (CPSC):
01 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.

D. National Institute of Justice:
01 Standard, NIJ-STD-0108.01.

E. Code of Federal Regulations (CFR):
01 CFR Title 16 Part 1201 category I and II – Safety Standards for Architectural Glazing Materials

F. Filti Testing and Development Shooter Attack Certification
01 FTD-SA-C1 (third party tested) shooter attack test method

1.4 QUALITY ASSURANCE

A. Installer Qualifications:
01 Engage an experienced installer certified, licensed, or otherwise qualified by film manufacturer as having the necessary experience, staff, and training to install manufacturer's products according to specified requirements.

B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts, and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.5 WARRANTY

A. Submit a written warranty, executed by the film manufacturer, agreeing to repair or replace defective safety and security film for a warranty period of minimum fifteen (15) years.

B. Failures include, but are not limited to:
01 Delamination, demetallizing, cracking, crazing.
02 Adhesive failure
03 Objectionable appearance, discoloration, changing color.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Design of Safety and Security Films is based on products / systems provided by Armoured One, LLC. No substitutions.

2.2 FILM MATERIALS

A. Design of Safety and Security Films is based on Armoured One 23 mil Shooter Attack Security Film. No substitutions.

B. Film Properties:
   01 Tensile Strength: 35,000 psi
   02 Break Strength: 640 lbs per inch width
   03 Elongation Strength: 230%
   04 Peel Strength: 10-11 lbs/in

C. Solar Performance Properties: Film applied to 1/8” thick clear glass
   01 Visible Light Transmissed: 87%
   02 UV Block: >99%
   03 Visible Light Reflected (Interior): 12%
   04 Visible Light Reflected (Exterior): 12%
   05 Shading Coefficient: 0.93
   06 Solar Height Gain Coefficient: 0.81
   07 U-Value Winter: 1.03

D. Flammability: The Manufacturer shall provide independent test data showing that the window film shall meet the requirements of a Class A Interior Finish for Building Materials for both Flame Spread Index and Smoked Development Values per ASTM E84.

2.3 STRUCTURAL SEALANT MATERIALS

A. Design of Safety and Security Sealants is based on DOW Corning DOWSIL 795 Silicone Building Sealant, DOWSIL 995 Structural Silicone Sealant, or glazing film manufacturer-approved equal.

B. Compatibility: Provide joint sealants and accessory materials that are compatible with one another, with joint substrates, and with materials in close proximity under use conditions, as demonstrated by sealant manufacturer by testing and related experience.

C. Structural adhesive to be color matched whenever possible, as allowed by availability from structural sealant manufacturer. Color matched is described as matching the color of the existing glazing bead/gasket.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Do not begin until glazing work is complete.

B. Examine glazing work to determine suitability for safety and security film installation to commence. Notify Contractor of any discrepancies; and do not proceed until resolved.

3.2 PREPARATION

A. Verify all conditions at glazing framing material and follow sealant manufacturer's specific instructions for preparation of frame material(s).

B. Comply with manufacturer's written instructions for surface preparation.

C. Prepare surfaces using methods and materials recommended by the manufacturer for the specific installation.

D. Protect window frames and adjacent work from damage during installation.

3.3 FILM INSTALLATION

A. Install all safety and security film in strict accordance with the manufacturer's installation instructions, standards and recommendations.

B. Safety and security film to be installed on interior-most surfaces of glass.

3.4 SEALANT INSTALLATION

A. Install all sealants in strict accordance with the manufacturer's installation instructions, standards and recommendations.

3.5 CLEANING

A. Use cleaning methods recommended by glazing film manufacturer.

3.6 PROTECTION

A. Protect glass film from damage by promptly installing streamers or ribbons, suitably attached to the framing and held free from glass.

B. Protect all glass film during and after installation from marring, blemishes, scratches and damage due to incidental adjacent work.

C. If damaged, make all necessary repairs or replacements in accordance with the manufacturer's recommendations and as directed by the Architect.

END OF SECTION

SECTION 08 90 00

LOUVERS AND VENTS

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide louvers and vents in exterior walls as indicated on the Drawings.

C. Related Work:
   01 Section 07 42 13 – Metal Wall Panels
   02 Section 13 34 19 – Metal Building Systems

1.2 SUBMITTALS

A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

E. Color / Finish Samples:
   01 Provide two (2) samples of each finish for selection by the Architect.
   02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
   03 Minimum size shall be 3" x 3" but must be large enough to convey attributes of the proposed product.

1.3 REFERENCES

A. American Architectural Manufacturer's Association (AAMA):
   01 AAMA 605.2 - High Performance Organic Coatings on Architectural Extrusions and Panels.

B. Air Movement and Control Association (AMCA):
   01 AMCA 500 - Test Methods for Louvers, Dampers and Shutters.
   02 AMCA 511 - Certified Ratings Program for Air Control Devices.
   03 AMCA 550 – Test Method for High Velocity Wind Driven Rain Resistant Louvers

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Design of louvers and vents is based on products Ruskin.

B. Acceptable Manufacturers: the following manufacturers are acceptable to provide products of this Section provided proposed products meet or exceed all specified requirements:
   01 Airstream Products
   02 All-Lite
   03 Construction Specialties, Inc.

2.2 MATERIALS

A. Design of louvers is based on Ruskin Model HZ700MD extreme performance louver.

B. Louver Materials and Fabrication:
   01 Performance Ratings: AMCA 550 listed.
   02 Size(s): As indicated on the Drawings.
   03 Frame:
      a. Material: Extruded aluminum, Alloy 6063-T6.
      b. Wall Thickness: 0.080 inch (2.0 mm), nominal.
      c. Frame Depth:
         1. Front Frame: 4 inches
         2. Back Frame: 3 inches
   04 Blades:
      a. Style: Horizontal front blade on 3.8" center to center spacing and rear blade on a ¾" center to center spacing.
      b. Material: Extruded aluminum, Alloy 6063-T6.
      c. Wall Thickness:
         1. Front blade: 0.080 inch (2.0 mm), nominal.
         2. Rear Blade: 0.050 inch (1.3 mm), nominal.
   05 Finish:
      a. Kynar 500
      b. Color to be selected by Architect from full-range of standard colors.
   06 Bird Screen:
      a. Material: 5/8" x 0.040" expanded, flattened aluminum.
      b. Frame: Removable, rewireable.

C. Performance Data:
   01 Based on testing 48-inch x 48-inch size unit in accordance with AMCA 500.
   02 Free Area: 53 percent, nominal.
   03 Free Area Size: 8.49 square feet.
   04 Maximum Pressure Drop at 1,000 fpm: 0.31 inches W.G.
   05 Water Penetration: Maximum of 0.01 ounces per square foot (3.1 g/m^2) of free area at an air flow of 803 feet per minute free area velocity when tested for 15 minutes.

D. Wind Driven Water Penetration Performance:
   01 Based on testing 39 inches x 39 inches (1 m x 1 m) core area, 41 inches x 44 inches (1.04 m x 1.12 m) nominal size unit in accordance with AMCA 500-L.
   02 Wind Velocity: 29 mph (47 kph).
      a. Rainfall Rate: 3 inches/hour (76 mm/hour).
      b. Free Area Velocity: 1562 feet per minute (7.9 m/s).
      c. Water Resistance Effectiveness: 99.8% (AMCA Class A).
   03 Wind Velocity: 50 mph (80 kph).
      a. Rainfall Rate: 8 inches/hour (203 mm/hour).
      b. Free Area Velocity: 1558 feet per minute (7.9 m/s).
      c. Water Resistance Effectiveness: 99.8% (AMCA Class A).

E. Design Load: Incorporate structural supports required to withstand wind load of +/-130 PSF.

F. Sub-Sill Flashing:
   01 All louvers shall be furnished with continuous sub-sill flashing, spanning the full width of the rough opening.
   02 Sub-sill flashing shall be minimum 0.065” aluminum with integral (turned up) end dams and back dams. Minimum height of dams shall be 1”.
   03 Open vertical joint at end dam / back dam junction shall be TIG welded continuous to form a seamless dam component directing any / all trapped water to outside of building.
   04 Finish of sub-sill flashing shall match louver finish.
   01 Provide a 1” glazing frame at louvers located in window wall systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate with Contractor and other trades as required for rough opening and blocking requirements for proper installation of louver and vent assemblies.

B. Confirm rough opening size and preparation are correct prior to start of installation.

3.2 INSTALLATION

A. Install work of this Section in strict accordance with manufacturer's printed instructions and final accepted submittals.

B. Louver sub-sill flashing shall be set in a full bed of sealant.

C. Coordinate to have all sides of louver and vents sealed continuous to adjacent materials.

D. For operable louvers and vents, completely test all functions to confirm all mechanical elements of the assembly are functioning correctly.

E. Provide continuous sealant at perimeter of frame after installation.

END OF SECTION

SECTION 09 21 13

PLASTER ASSEMBLIES

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Exterior cement plaster.

C. Related Work:
   01 Section 09 91 00 - Painting and Re-Painting

1.2 SUBMITTALS

A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.
   04 Provide elevations indicating layout of all proposed plaster joints.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01 Include recommended cleaning products and instructions for use.
   02 Where applicable, provide recommended maintenance schedules and procedures.

F. Color / Finish Samples:
   01 Provide two (2) samples of each finish for selection by the Architect.
   02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
   03 Minimum size shall be 3” x 3” but must be large enough to convey attributes of the proposed product.
   04 Upon selection of plaster finishes / colors by Architect, provide two (2) 12”x12” samples of each selected finish / color.

1.3 QUALITY ASSURANCE

A. ASTM International:
   01 A653/A653M-13 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   02 A1064/A1064M-14 - Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
   03 C11-13 - Terminology Relating to Gypsum and Related Building Materials and Systems.
   04 ASTM C35 76 - Inorganic Aggregates for Use in Gypsum Plaster Type II.
   05 C91/C91M-12 - Masonry Cement.
   06 C150/C150M-12 - Portland Cement.
   07 C206-14 - Finishing Hydrated Lime.
   08 C207-06 - Hydrated Lime for Masonry Purposes.
   09 C260/C260M-10a - Air Entraining Admixtures for Concrete.
   10 C847-14a - Metal Lath.
   11 C897-05 - Aggregate for Job-Mixed Portland Cement Based Plasters.
   12 C926-14a - Application of Portland Cement-Based Plaster.
   13 C932-06 - Surface-Applied Bonding Compounds for Exterior Plastering.
   14 C933-14 - Welded Wire Lath.
   15 C979/C979M-10 Pigments for Integrally Colored Concrete.
   16 C1002-14 - Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
   17 C1063-14d - Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster.
   18 E90-09 - Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
   19 E119-14 - Test Methods for Fire Tests of Building Construction and Materials.
   20 E413-10 - Classification for Rating Sound Insulation.

B. Federal Specifications: Fed. Spec. SS-L-00351a, Type F.

C. Metal Lath Manufacturer's Association.

D. American Subcontractor's Association: ASA No. A42.4.

E. Texas Lathing and Plastering Contractor Association / Texas Bureau for Lath and Plaster.

1.4 WARRANTY

A. The plaster Contractor shall guarantee the work required and performed under this section will be free from defects in workmanship and materials for a period of five (5) years from date of substantial completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The following manufacturers are acceptable provided proposed products meet or exceed all specified requirements.

B. Portland / Masonry Plaster:
- 01 Holcim
- 02 National Gypsum Co.
- 03 TEIFS / ParexUSA
- 04 TXI

C. Lath & Metal:
- 01 Alabama Metal Industries Corp. (Amico).
- 02 Bailey Metal Products Limited
- 03 Bostwick Steel Lath Co.
- 04 Dietrich
- 05 Fry Reglet
- 06 Marino Industries
- 07 United States Gypsum Co.
- 08 Western Metal Lath Co.

D. Acrylic Finish Coat:
- 01 Dryvit
- 02 Finestone
- 03 R-Wall
- 04 Senergy
- 05 STO

2.2 MATERIALS

A. Cement Plaster:
- 01 Portland cement: comply with ASTM C-150, Type I.
- 02 Sand: provide sand that meets ASTM C-144 (Sharp Torpedo Type) finish coat graded per ASTM C842.
- 03 Water: potable.
- 04 Fiberglass Strands: 1/2 inch alkaline resistant

B. Finish Type:
- 01 Stucco

C. Plaster Framing / Furring:
- 01 Main Runner Channels. 1-1/2" cold rolled, hot dip galvanized channels or hat-sections; minimum 0.0538” bare steel thickness; minimum 33 KSI steel.
  - a. Comply with ASTM A 653.
  - b. Nominal weight: 480 PMLF.

02 Lathing Channels. 3/4" cold rolled, hot dip galvanized channels or hat-sections; minimum 0.0538” bare steel thickness; minimum 33 KSI steel.
a. Comply with ASTM A 653.
b. Nominal weight: 305 PMLF.

D. Metal Lath:
01 General: 3.4 lbs. per SY, hot-dipped galvanized.
02 Metal Lath on Metal Plaster Framing: Expanded type, diamond shape.
03 Metal Lath on Non-Dampproofed Solid Surfaces: Expanded type, diamond shape, self-furring.
04 Metal Lath on Dampproofed Solid Surfaces: Expanded type, diamond shape, self-furring; backed with a asphalt saturated Kraft paper (Federal Spec UU-B-790a, Type 1, Grade 2, Style 2).
05 Lath Tie Wire: minimum 18-gauge, cold drawn galvanized steel wire.
06 Lath Screws: #10 x 1-1/4”, self-tapping, Round Washer Head or Modified Truss Head, K-Lath lathing screws, zinc plated.
07 Power Actuated: 3/8” diameter shank, minimum 3/4" length power actuated fasteners; zinc plated.
08 Lath Staples: Minimum 14 gauge, 1-1/2” leg, ¾” crown staples; or approved equal.

E. Accessories:
01 Pure zinc alloy or 1063 T5 aluminum unless otherwise noted.
02 Casing Bead / Plaster Stop: Design is based on Amico No. X-66 Casing Bead, with 3” wings and grounds of depth of associated plaster.
03 Control Joint: Design is based on Amico No. XJ15 Griplock J Control Joint.
04 Expansion Joint: Design is based on Amico no. 40 plaster expansion joint, grounds of depth of associated plaster.
05 Corner Bead / Key: Design is based on Fry Reglet No. PCM-75-75-150.
06 Soffit Vent: Design is based on Fry Reglet No. DS-875-V-200 or WPM-75-V-200; 2” reveal, vented soffit molding. Shape as applicable to application condition.
07 Interior Corner Reinforcement. 2" x 2" or corner master #30 USG Self-Edge Cornerite, or Cornermaster #30.
08 Drip Screed. Fry Reglet Corp., aluminum drip screed DS-875.

F. Fasteners:
01 Wire shall be galvanized annealed steel wire, in 18 gauge or 16 gauge as appropriate for use and shall comply with Federal Spec FSQQ-W-461g.AS.
02 Screws: Wafer head lathers Type S with length that penetrates steel substrate a minimum of 3/8”. Comply with ASTM C 1002 and / or ASTM C 954.
03 Nails: Galvanized 11 gauge with a 3/8” diameter head and length to penetrate wood framing a minimum of 3/4". Comply with Federal Spec FF-N-105.

2.3 MIXES

A. Portland Cement Plaster:
01 Scratch Coat – Mix Proportions:
a. 1 sack Portland cement (94 lbs.).
b. 2 sacks masonry mix.

c. 9 cu. ft. sharp torpedo plaster sand.
d. 1-1/2 lbs. of 1/2" alkaline resistant fiberglass strands.

02 Brown Coat – Mix Proportions:
a. 1 sack Portland cement (94 lbs.).
b. 2 sacks masonry mix.
c. 9 cu. ft. sharp torpedo plaster sand.
d. 1-1/2 lbs. of 1/2" alkaline resistant fiberglass strands.
e. Liquid or powdered waterproofing used according to the manufacturer's recommendations.

03 Stucco Finish Coat: Oriental Plaster Mix

04 Acrylic Finish Coat: Factory mixed 100% pure acrylic based integral color.

B. Gypsum Plaster:
01 Base coat lath, one part plaster to two parts sand by weight.
02 Brown coat, one part plaster to three parts sand by weight.
03 Finish coat, one part plaster to two parts sand.

PART 3 - EXECUTION

3.1 PREPARATION

A. Cold Weather:
01 Do not use frozen material.
02 Do not apply cement plaster to frozen surfaces or surfaces containing frost.
03 Do not mix materials or apply cement plaster when ambient temperature is less than 35°F/1.6°C.
04 A temperature of at least 55°F must be maintained prior to plaster application, during its application, and until it is dry. Any plaster work, which freezes within 48 hours of application, shall be removed and replaced with new plaster.

B. Hot Weather:
01 Protect cement plaster from uneven and excessive evaporation during hot, windy, and dry weather.
02 Moist curing after each coat of cement plaster with water if ambient temperature is more than 75°F/24°C. Moist cure for 48 hours after application of coats.
03 Hot, or dry, or windy weather the cement plaster should be moistened down and then covered with a single sheet of polyethylene plastic (clear only).
04 Moist curing is required at the start and end of workday.
05 Humidity higher than 75 percent. Moist curing not required.

C. Remove rust, oil, grease or other foreign substance which might hinder good bond from lath immediately prior to application of plaster.

D. Commencing work shall be construed as acceptance of preceding work performed by others as suitable to receive work specified in this division.

E. Erect and maintain scaffolding in accordance with all applicable laws and regulations, local or other.

F. Manufactured products shall be delivered in original packages, containers or bundles, bearing manufacturer's name and brand.

G. Mix in accordance with manufacturer's direction. Protect mixes from frost, dust and evaporation. Clean mixers, boxes and tools after each batch.

H. Mix thoroughly with correct amount of water until uniform color consistency. Measure materials accurately.

I. Mix materials dry to uniform color and consistency before adding water.

J. Mix only as much plaster as can be used in one hour.

K. Do not re-temper mixes after initial set has occurred.

L. Do not apply finish coat when there is any form of precipitation. Protect cement plaster from all forms of precipitation during the application and the setting/curing period of finish coat. Ensure that the finish is fully set prior to removing protective covering.

3.2 APPLICATION

A. Furring and Soffit Framing:
   01 Main runner channels (1-1/2") and lath channels (3/4") shall be spaced at 4'-0" O.C. and 16” O.C. respectively.
   02 The use of 16-gauge galvanized metal studs (3-5/8" wide) may be used as miscellaneous framing to achieve soffit geometry as approved by the Architect.
   03 All galvanized hanger wires shall be spaced at 4'- 0" O.C. maximum. Do not use power actuated anchors through metal deck for wire supports.
   04 Prepare all framing to receive recessed lights and control joints.
   05 Exterior soffit locations provide 1-1/2” cold rolled channel stiffeners secured to grid and structure above, space 8 ft., each way.

B. Metal Lath on Plaster Framing:
   01 Secure lath to channels by tying securely with two loops of 18 or 16-gauge tie-wire at 6" O.C. spacing maximum.
   02 Lap metal lath a minimum of 2” over supports.
   03 Apply lath with long dimension of sheet across supports.
   04 All lath shall be tightly stretched, free from looseness, bags, and bulges.

C. Metal Lath on Dampproofed Sheathing:
   01 Secure lath with screws into metal studs through sheathing. Screw lath to studs at maximum 8” O.C.
   02 Lap metal lath a minimum of 2” over stud supports.
   03 Apply lath with long dimension of sheet across supports.
   04 All lath shall be tightly stretched, free from looseness, bags, and bulges. Use additional staples as required to assure lath is flat and flush.

D. Metal Corner Beads:
   01 Provide on all external plaster corners in single lengths where length of the corner does not exceed 12 feet.

02 Fasten securely with tie wire spaced 8" O.C. staggered in two wings.

E. Casing Beads:
01 Install at edges of all horizontal planes and elsewhere as indicated on drawings.
02 All junctions shall be mitered.
03 Horizontal surfaces shall be isolated from all vertical surfaces.

F. Control Joints:
01 It is not required to cut lath behind control points, it is required to cut lath behind expansion joints.
02 Panels should be relatively square.
03 Notify architect if plaster areas exceed 12 LF in length without a control joint.
04 Install control joints for surface areas of approximately 150 square feet whether shown or not. Verify locations with Architect.
05 Install where dissimilar back-up materials join whether detailed or not.

G. Soffit Vent Molding:
01 Install soffit vent molding, continuous on three sides of horizontal plaster installations.
02 Verify substrate for vent attachment and provide the appropriate type fastener for the application.

H. Portland Cement Plaster:
01 Trowel apply base coat with sufficient force to form good keys and bond. Allow to harden and scratch to produce rough surface. Keep moist until application of brown coat.
02 Apply brown coat, scratch for bond and allow to set hard. Keep moist until application of finish coat.
03 Use in all exterior locations and interior locations where noted.

I. Finish Coat:
01 Stucco finish at all ceilings and exterior soffits. Mix and apply in accordance with manufacturer's written instructions. No scaffold lines or other marks are allowed due to the application. Match colors and textures of approved samples.

3.3 CLEAN UP AND PROTECTION

A. Rubbish and debris shall be removed as often as necessary. As each room or space is complete, remove all rubbish, debris, scaffolding and tools, and leave broom clean.

B. Clean plaster spots from work of other trades. Protect finish plaster from injury.

END OF SECTION

SECTION 09 21 16

GYPSUM BOARD ASSEMBLIES

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Interior metal framing – studs and joists.
   02 Interior gypsum board at walls, including trim, taping and floating.
   03 Interior gypsum board at ceilings, including trim, taping and floating.
   04 Interior glass-mat backer board at ceramic tile and masonry wall finishes.
   05 Exterior sheathing.

C. Related Work:
   01 Section 05 41 00 – Structural Metal Stud Framing.
   02 Section 05 50 00 – Metals Fabrications.
   03 Section 06 10 00 – Rough Carpentry.
   04 Section 07 21 00 – Thermal Insulation.
   05 Section 07 21 19 – Foamed-in-Place Insulation.
   06 Section 07 25 00 – Weather Barrier.
   07 Section 07 84 13 – Penetration Firestopping.
   08 Section 09 51 13 – Acoustical Tile Ceilings.
   09 Section 09 91 00 – Painting and Re-Painting.

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.
   04 Where proposed framing solutions exceed specified maximum allowable unbraced heights, submit engineered calculations for each specific condition; sealed and signed by a Texas licensed structural engineer.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.

01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
02 Generic details that do not depict actual conditions shall not be acceptable.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):
01 ASTM C473 – Standard Test Methods for Physical Testing of Gypsum Panel Products.
02 ASTM C475 – Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
03 ASTM A653/A653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by Hot-Dip Process.
04 ASTM C840 – Standard Specification for Application and Finishing of Gypsum Board.
05 ASTM C954-10 – Standard Specifications for Steel Drill Screws for the Application of Gypsum Panel Products to Steel Studs.
06 ASTM C1002 – 07 – Standard Specifications for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products to Steel Studs.
07 ASTM C1178 – Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
08 ASTM C1280 – Standard Specification for Application of Gypsum Sheathing.
09 ASTM C1396 – Standard Specification for Gypsum Board.
10 D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
11 ASTM E119 – Standard Test Methods for Fire Tests of Building Construction and Materials.

B. Gypsum Association:
01 GA-214 – Recommended Levels of Gypsum Board Finish.
02 GA-216 – Application and Finishing of Gypsum Panel Products.
03 GA-253 – Application of Gypsum Sheathing.
04 GA-290 – Area Separation Walls.
05 GA-600 – Fire Resistance Design Manual.

C. National Fire Protection Association:
01 NFPA 285 – Standard Fire Test Methods for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Materials.

1.4 DESIGN REQUIREMENTS

A. Non-Load-Bearing Metal Framing Deflection:
01 L/360 at 5 PSF for veneer plaster and direct-applied finish materials that use grout or mortar.
02 L/240 at 5 PSF for typical gypsum board walls.

B. Fire-Resistive Rating: Where indicated on Drawings, provide materials and construction that are identical to those assemblies whose fire resistance rating

has been determined per ASTM E119 by a testing and inspecting organization acceptable to authorities having jurisdiction.

C. Meet or exceed fire resistance requirements outlined under provisions of the GA-600 Fire Resistance Design Manual for wall and ceiling assemblies.

D. Meet or exceed Class A flame/fuel/smoke requirements of ASTM E84 surface burning characteristics for finish materials.

E. Sound Transmission Characteristics: For gypsum board assemblies with STC ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by a qualified independent testing agency.

F. Impact-Resistant Characteristics: No structural failure at 400 foot pounds per ASTM E195.

G. Mold-Resistant Characteristics: Rating of 10 according to ASTM D3273 mold testing.

H. Recycled Content Certification: Provide gypsum board of at least 95 percent recycled content.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers or bundles bearing name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic and other causes. Neatly stack gypsum boards flat to prevent sagging.

C. Handle gypsum board to prevent damage to edges, ends, and surfaces. Do not bend or damage metal corner beads and trim.

D. Any gyp.bd. that comes in contact with water shall not be used and shall be removed from the jobsite.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The design of metal stud drywall framing and similar components is based on products manufactured by ClarkDietrich.

B. The following additional metal stud framing manufacturers are acceptable provided proposed products meet or exceed all specified requirements.
01 Marino/Ware.
02 Dale Industries, Inc.
03 National Gypsum Company

C. Gypsum Wall Board: Provide domestically manufactured gypsum wall board.
01 U. S. Gypsum Co.
02 National Gypsum Company.

03 American Gypsum.
04 Georgia Pacific.
05 James Hardie Industries.

D. Exterior Sheathing:
01 Georgia Pacific, “Dens Glass Gold” – basis of design.
02 U.S. Gypsum “Securock”.
03 National Gypsum, Gold Bond “eXP” Extended Exposure Sheathing.
04 Temple-Inland Forest Products Corp. “Green Glass”.

E. Glass-Mat Backer Board:
01 USG Durock – basis of design.
02 James Hardie Industries.
03 Certainteed.

F. Substitutions of above must be approved by the Architect 10 days prior to proposal / bid date

2.2 STUD FRAMING MATERIALS

A. The Drawings indicate locations of partitions / stud framing and the size of the stud to be used. The contractor is responsible for providing the appropriate stud mil thickness relative to the height and configuration of the assembly.
01 The minimum thickness for all interior framing materials shall be 33 mils.
02 Physical features of materials proposed to be furnished shall meet or exceed all requirements outlined below.

B. All metal framing members shall be channel type, screw type studs and runners, punched cee studs.
01 33 mil and 43 mil material fabricated from steel with minimum 33 KSI yield strength.
02 54 mil and heavier materials fabricated from steel with minimum 50 KSI yield strength.
03 Conforming to ASTM C645 Standard Specification for Non-Structural Steel Framing Members.
04 Minimum G-40 galvanized steel – ASTM A653. Galvannealed material is not acceptable. Coating equivalents are not acceptable.
05 Provide in sizes as indicated on the drawings and required for the actual installation assembly.

C. Interior partition and similar metal framing is based on three (3) primary stud thicknesses. The following is the minimum Mil thicknesses for studs:
01 33 Mils minimum stud thickness to be provided at any location; unless indicated otherwise on the Drawings or required to be heavier by specification or unbraced assembly height as determined by the installer.
02 43 Mils (18 Gauge).
03 54 Mils (16 Gauge).
04 68 Mils (14 Gauge).

D. Mil thicknesses of studs shall be based on 16” O.C. framing with the maximum, laterally unbraced height at each condition in accordance with the following schedule based on gypsum board applications:
01 5 PSF at L/240 conditions; standard gyp board drywall partitions to receive a painted or vinyl wall covering finish.

Stud	Height	Height	Height	Height

Size	33 Mils	43 Mils	54 Mils	68 Mils
2-1/2”	12’-7”	N/A	N/A	N/A
3-5/8”	16’-9”	18’-3”	19’-6”	20’-10”
6”	24’-9”	27’-2”	29’-2”	31’-3”

02 5 PSF at L/360 conditions; gyp board drywall partitions to receive a finish material utilizing grout, mortar or plaster.

Stud Size	Height 33 Mils	Height 43 Mils	Height 54 Mils	Height 68 Mils
2-1/2”	11’-0”	N/A	N/A	N/A
3-5/8”	14’-8”	15’-11”	17’-1”	18’-3”
6”	21’-8”	23’-9”	25’-6”	27’-3”

03 Where heights exceed limits stated above, framing at less than 16” O.C. or use of heavier mil thicknesses shall be allowed, conditional on submittal of engineered calculations for each specific condition; sealed and signed by a Texas licensed structural engineer.

E. The gross Section Modulus (Sx) value for interior metal framing members shall be minimum:

Member Size	33 Mil Sx	43 Mil Sx	54 Mil Sx	68 Mil Sx
2-1/2”	0.180	0.238	0.288	0.355
3-5/8”	0.258	0.334	0.410	0.503
6”	0.520	0.675	0.832	1.026

F. All above material mil thicknesses, performance criteria and related values are minimum requirements.

01 Under NO circumstances shall any stud product less than 33 mils be acceptable.

02 Gauge equivalent / dimpled and similar products whose base materials do not meet the above criteria, performance and properties shall not be accepted under any circumstances.

03 The “ProSTUD 33” series as manufactured by ClarkDietrich meets all criteria and is acceptable. Track sections from the ProSTUD 33 system are acceptable.

04 The “ViperStud 20 STR 33 mil” series as manufactured by Marino Ware meets all criteria and is acceptable. Track sections from the ViperStud 20 STR 33 mil system are acceptable.

G. Stud tracks shall be provided in the same mil thickness or heavier than the studs they are associated with.

01 Stud sill / floor track leg height shall be minimum 1-1/4”.

02 Head tracks which anchor to structural steel or floor / roof deck shall have a minimum 2” leg height (deep track) and be fabricated and installed to allow movement and flexibility of studs nested within the track.

H. Studs at all framed door and window openings shall be installed with full-height (floor to top of wall), double studs at jambs.

01 Double studs at opening shall be clipped / fastened together to result in a single composite assembly.

02 Coordinate with other trades where additional miscellaneous steel bracing is required.

03 Framed openings for mechanical ductwork and similar work shall be framed as required for the assembly.

04 Fastening studs directly to ductwork is not permitted. Coordinate with other trades as required. Adhere to U.L. requirements at fire rated partitions.

I. Metal framed partitions scheduled to receive tile finish or other applied finishes containing mortar or grout shall be increased to the next higher mil thickness for the height designated above.
   01 Examples: 33 mil increased to 54 mil; 54 mil increased to 68 mil.
   02 No increase is required for 68 mil framing.
   03 Contractor's option: stud framing size / mils based on height limitations per above may be installed at 8" O.C. in lieu of the stated increase in mil thickness.

J. Structural metal stud bracing is required at each door opening 48" or wider.
   01 Provide two (2) 54 mil studs at each jamb of frame.
   02 Studs shall be fastened together to form a single composite unit.
   03 Studs shall extend and be secured to steel structure above.
   04 Field verify conditions and requirements.

K. Horizontal Bracing: shall be minimum 54 Mil cold rolled channels with 1/2" legs. Provide in sizes in accordance with punched openings in studs.
   01 Horizontal bracing shall be either welded in place to each stud; or fastened with a clip specifically designed for the purpose.
   02 Provide one row of horizontal bracing at mid-span of partitions up to 12'-0" high; and at 5'-0" O.C. for partitions higher than 12'-0".

L. Provide all accessories including, but not limited to, tracks, clips, web stiffeners, spacers, anchors, fastening devices, resilient clips, and other accessories required for a complete and proper installation, and as recommended by the manufacturer for the steel member and assembly being used.

M. Ceiling Framing:
   01 U-Channel Framing: Minimum 1-1/2" x 54 mil cold rolled steel channels with hot dip galvanized finish. Use for primary framing at suspended ceilings and elsewhere as indicated.
   02 Furring Channels: Standard 2-3/4" wide, 7/8" deep x 30 mil minimum galvanized sheet metal furring channels.
   03 Ceiling Hanger and Tie Wire: 9 gauge galvanized hanger wire and 16 gauge tie wire.
   04 Fixture Reinforcement: 6 inch, 14 gauge / 68 mil cold rolled steel galvanized channels.

N. Wall Furring:
   01 Furring Channels: standard 1-1/2" and / or 7/8" deep x 30 mil minimum galvanized sheet metal 'hat section' furring channels.
   02 Refer to Drawings for size at each application.

O. Metal to Metal Connections:
   01 Framing fasteners shall be self-drilling / self-tapping screws.
   02 Framing screws shall be #10-16x5/8" hex washer head screw.
   03 Welded connections shall be fillet or flare welds as recommended by the manufacturer for the specific connection conditions.

2.3 WALL AND CEILING BOARD MATERIALS

A. General Design Basis: All gypsum wallboard shall be USG 5/8 inch thick, Type X, tapered-edged. Sizes shall be 4'-0" wide by longest practical length to minimize joints.

01 Suitable for use in fire rated assemblies.

B. Humidity Resistant Gypsum Wallboard shall be USG 5/8", Type X, Sheetrock "Mold Tough" gypsum panels.
01 Panels shall comply with ASTM D3273.
02 Use at all walls and ceilings in high humidity rooms (locker rooms, shower rooms / stalls, food service areas / rooms, teacher lounge(s), custodial room(s), Kindergarten/Pre-K classroom(s), Resource Classroom(s), ECSE Classroom(s), clinic, restrooms, non-air-conditioned interior spaces / rooms) that do not receive a masonry finish.
03 Also provide within 24" of all sinks and lavatories.

C. Tile or Masonry Finish Substrate: A cement-based backer board manufactured specifically for tile substrate and use in wet locations. Use as wall board substrate at all tile or masonry finished surfaces.
01 Minimum 5/8 inch thick.
02 Provide / install in greatest size sheets possible (48" x 96" or larger) to minimize joints.
03 Use joint reinforcement and fasteners in accordance with manufacturer's printed instructions.

D. Acceptable manufacturers / products include:
01 USG "Durock" (basis of design).
02 James Hardie Industries "HardieBacker".
03 National Gypsum "Permabase".

E. Moisture-resistant board:
01 Acceptable Products:
a. 13 mm Komatex PVC Board as manufactured by Kommerling
b. 7/16" thick HardieTrim as manufactured by James Hardie Building Products, Inc.
02 Use at base of all interior gypsum board and metal stud partitions whether indicated on drawings or not.
03 Shim moisture-resistant board as required so face of product is aligned with face of adjacent gypsum board.
04 Prime and paint to match adjacent wall finish.

F. Impact-Resistant Gypsum Board: Wallboard specifically designed to offer protection against impact and penetrations into the wall cavity.
01 Design of Impact-resistant Gypsum board is based Hi-Impact XP Gypsum board by National Gypsum; or equal approved by the Architect.
02 Minimum 5/8" thick
03 Type X, suitable for fire-rated assemblies
04 Provide / install in greatest size sheets possible (48" x 96" or larger) to minimize joints.
05 Use joint reinforcement and fasteners in accordance with manufacturer's printed instructions.
06 Edges: tapered
07 Mold, mildew and moisture resistant
08 Use at locations indicated on drawings
09 Provide level 5 finish on all impact-resistant gypsum board exposed to view.

G. Corner Beads: No. 28 gauge galvanized steel, 1-1/4 inch legs. Use at all exterior corners.

H. Joint Compound (Taping): Standard types manufactured by gypsum wallboard manufacturer for intended use. Fire rated type must be used on fireproof systems.

I. Laminating Adhesives: Standard type manufactured or recommended by manufacturer of product to be laminated.

J. Gypsum board reveals shall be 1/4” wide by 5/8” deep drywall reveals; extruded aluminum, painted finish.
   01 Provide where indicated on the Drawings.
   02 Acceptable manufacturers / products include:
      a. Gordon ‘Final Forms I’ Series 500 (basis of design).
      b. Fry Reglet -. “DRM” Series.
      c. Pittcon - “SWR” Series.

K. Control Joints: Metal type with 1/4 inch open joint, perforated flanges for floating in place.
   01 Niles Building Products model 093 Zinc Control Joint; or equal.
   02 Control joints at walls shall be located vertically.
      a. A maximum of 30'-0" O.C. floor to above ceiling.
      b. Each side of door frames from top of jamb to above ceiling.
      c. Above ceiling, cut / separate gyp board full height to top of gyp board.
   03 Control joints at gypsum board ceilings shall be located:
      a. As indicated on the Drawings
      b. Where not indicated, at a maximum of 30’-0” O.C. Coordinate with Architect for exact locations.
   04 Control joints at furdowns shall be located on all sides of the furdown at a maximum of 30'-0" O.C. to above ceiling.
   05 At building expansion joints, provide control joint full height of gyp board unless detailed or specified otherwise.

L. Exterior Sheathing:
   01 Mold-resistant, fire-rated glass-mat gypsum sheathing board.
   02 Thickness: 5/8 inch (16 mm).
   03 Properties: Enhanced mold resistance per ASTM D3273. Glass facers on both sides.
   04 Water absorption less than 6 percent per ASTM C473.
   05 Configuration: Forty-eight inches (1219 mm) wide by length required with square edges for horizontal application.

M. Fasteners (screws) shall be U.S.G. type “S” drywall screws, minimum 1-1/4” length, or longer as required to penetrate metal framing components a minimum of 1/2".

2.4 GLASS-MAT BACKER BOARD

A. Design of glass-matt backer board is based on USG Durock Tile Backerboard.

B. Treated water-resistant gypsum core that is covered with a coated fiberglass mat-facer and cementitious surface, specifically designed for use as a substrate for direct applied tile of masonry.

C. Properties:

01 Thickness: 5/8”.
02 Size: 48” x 96”.
03 Mold Resistance: 10 maximum per ASTM D3273.

D. Fasteners: Design is based on USG Durock Tile Backer Screws.
01 Length: 1-5/8”.
02 Corrosion resistant screws complying with ASTM B117.
03 Specifically designed for attachment of glass-mat backer board.

2.5 ACCESSORIES

A. Adjustable partition closure:
01 To be used at vertical junctions between partitions and window walls.
02 Mullion Mate 30 series extruded aluminum partition closure as manufactured by Gordon Interior Specialties Division, Gordon, Inc., 5023 Hazel Jones Road, Bossier City, LA 71111. (800) 747-8954.
03 Field paintable finish to match mullion color
04 Provide partition closure in lengths and size to fit specified opening. Refer to drawings.
05 Provide gasketing both sides, full height of partition closure
06 Provide 911-EC487 wall end cap full height of partition

PART 3 - EXECUTION

3.1 METAL FRAMING INSTALLATION

A. Floor Track: Attach to floor at 24-inch maximum centers with shoot-in pins or concrete nails.

B. All metal framing shall extend to floor or roof structure / deck above, unless shown otherwise on the Drawings.
01 Fasten tracks at 24” intervals and more often where necessary.
02 Where framing is perpendicular to joists, provide additional bracing as required.
03 At fire rated partitions, framing shall extend full height to floor or roof deck above to allow a full, tight fit and seal of gyp board to be applied.
04 Where studs are indicated to extend only above ceiling, brace to structure or other suitable framing at intervals not to exceed 32” O.C. each side and staggered. Framing used for bracing shall be minimum 33 Mil members.

C. Studs:
01 Single lengths positioned vertically in the runners, spaced 16 inches O.C. maximum unless otherwise shown. At classrooms, all metal framing within 4 feet of corridor doors (both sides of door), shall be spaced 12 inches O.C.
02 Install double studs at framed opening jambs. Install stud bracing on each side of opening at frame head height between jamb studs and adjacent studs.
03 Secure studs to stud track on both sides at bottom track prior to installation of gyp board.
04 Where framing extends to structure or floor / roof deck, secure studs to both sides at bottom track prior to installation of gyp board. Temporarily fasten top track to stud as required to hold plumb in place. Secure /

fasten gyp board to studs +/- 1” below bottom of track leg. Do not permanently fasten gyp board or stud directly to top track. Remove temporary track fastener to provide vertical movement of studs within the top track.

05 Where studs are indicated to extend only above ceiling, secure studs to both sides at top and bottom track prior to installation of gyp board. Brace to structure or other suitable framing at intervals not to exceed 32” O.C. one side only. Coordinate with other trades as required to avoid conflict.

D. Wall Reinforcement:

01 Provide horizontal bridging in all stud walls in accordance with the manufacturer’s standards and recommendations.

02 Provide solid, 2x (2x4 min.) treated wood blocking, spanning between wall studs, at all wall mounted fixtures, finish hardware, toilet partitions, wall cabinets, toilet accessories, specialties, built-in work and similar locations as required to provide a suitable substrate for firm attachment of other work.

E. Chase-Wall Bracing:

01 Install cross-bracing for chase wall construction; Mil thickness of bracing to equal stud Mil thickness.

02 Space braces a maximum of 36 inches vertically on every pair of studs.

3.2 WALLBOARD INSTALLATION

A. Select the maximum practical length to minimize end joints. All end joints shall be neatly fitted and staggered. Joints on opposite sides of partition shall be so arranged as to occur on different studs.

B. Install metal corner bead at external corners. Where length of the corner does not exceed standard stock lengths, use a single length.

C. Install gypsum board moisture guard on the bottom of all gypsum board sheets set at / on finish floor slabs.

D. Install metal trim where indicated and all wall board not terminating under frames or behind bases shall be trimmed with galvanized "J" mold.

E. Apply at least three coats of joint compound over beads, screw heads and trim, and each coat shall be feathered out onto panel faces. Refer to Para. 3.7 Workmanship Tolerances for level of finish required.

F. Float out and sand joints to make joints invisible when painted with non-texture paint. Refer to Para. 3.6 Workmanship Tolerances for level of finish required.

G. Caulk around pipes, ducts, structure or similar items which penetrate drywall systems.

H. Fasten wallboard at 12 inches O.C., except at the edges/joints which shall be at 8 inches O.C.

I. Edge-Grip Clips: Position clips on the back of the panels and drive prongs into panel edges. Space clips 16 inches O.C. Screw-attach clip to framing, furring or wall surface.

J. At all wrap-around hollow metal frames, gyp board shall extend ½" minimum into frame throat.

K. At all exterior metal framed walls extend gypsum wall board from floor to deck unless noted otherwise.

L. At all metal framed walls, stop gypsum wallboard 3 inches above finished floor and provide 3 inch rip of Cement/Hardi board.

3.3 SHEATHING INSTALLATION

A. Install sheathing in accordance with manufacturer's instructions and applicable instructions in Gypsum Association -253 and ASTM 1280.

B. Install using maximum lengths possible to minimize the number of joints.

C. Secure sheathing to metal framing with hot dip galvanized screws spaced 8 inches O.C. at perimeter of board and 12" O.C. in field of board. Do not countersink fasteners; drive them to bear flush with surface of sheathing. Locate fasteners at least 3/8" from edges.

D. Provide sheathing at all exterior metal framed walls unless noted otherwise. Install with all joints tight.

E. Accurately cut and scribe at interfacing / penetrating work.

F. Coordinate with the installation of dampproofing above grade. Refer to spec Section 07 11 13 – Bituminous Dampproofing.

3.4 GLASS-MATT BACKER BOARD

A. Install glass-mat backer board at all interior wall surfaces to receive direct applied ceramic or similar tile, plaster and thin-set masonry.

B. Install in full size sheets as much as possible to minimize joints.
   01 Install backer board with ends and edges closely abutted but not forced together.
   02 Stagger end joints in successive courses.

C. Fastening:
   01 For wall application, fasten glass-mat backer board to framing with specified fasteners.
   02 Drive fasteners into field of panels first, working toward ends and edges.
   03 Hold panels in firm contact with framing while driving fasteners.
   04 Space fasteners maximum 8" O.C. with perimeter fasteners at least 3/8" and less than 5/8" from ends and edges.
   05 Drive screws so bottoms of heads are flush with panel surface.
   06 Do not overdrive fasteners.

3.5 CEILING FRAMING INSTALLATION

A. Main Runners: Hanger wires (9 gauge) shall be spaced not over 4'-0" in the direction of 1-1/2 inch main runner channels, not over 4'-0" in the direction of right angles to the main runners, and within 6 inches of the ends of main runners and of boundary walls, girders or similar interruptions of ceiling continuity.

01 Do not place over 4’-0" O.C., properly positioned and leveled.
02 Suspension of ceiling framing from joist bridging is not permitted.

B. Furring Channels: Space 16 inches O.C., and saddle-tie with two strands of 16 gauge tie wire to main runners or main support members.
01 Do not let into or come in contact with abutting masonry walls.
02 End splices shall be provided by nesting channels or studs no less than 8 inches and securely wire-tie.

3.6 CEILING BOARD INSTALLATION

A. Apply gypsum board of maximum practical length with the long dimension at right angles to the furring channel and fastened with 1 inch drywall screws spaced 12 inches O.C. in the field of the board and along abutting ends.

B. Align abutting end or edge joints over the web surface of the furring channel. Tie neatly and accurately with end joints staggered.

3.7 CURVED GYPSUM WALLBOARD APPLICATIONS (PER USG #WB-1766)

A. Gypsum Wallboard: regular thickness of 1/4”, 3/8” or 1/2”, 48” wide by maximum length practical for the installation. Minimize joints.

B. Installation: Cut leg and web of top and bottom runners at 2 inch intervals for the length of the arc with 90 degree maximum uniform curve. Fasten 1 inch 18 Mil steel strip inside the cut leg of both runners with USG Metal Lock Fastener. Secure runners to framing in the floor and ceiling. Install studs between runners, twisting them into position, spaced as shown on back of this sheet. Studs may be fastened to runners to lessen their movement. However, if you must allow for deflection, cut studs 3/8 inch less than floor-to-ceiling height and do not fasten to top runner. Anchor to ceiling and floor runners a; studs for shelf-walls and walls adjacent to door/window frames, partition intersections, corners and free-standing furring. Install gypsum panels as follows:

Panel Thickness	1/4”	1/4”	3/8”	3/8”	1/2”	1/2”.
Radius	2’-0”	2’-6”	3’-0”	3’-6”	4’-0”	4’-6”
No of studs on Arc, including those at tangents	9	10	9	11	8	9
Approx. O.C. spacing	5.50”	5.93”	7.85”	7.22”	11.70”	11.40”

C. Cut gypsum board panels so that when applied horizontally they will run a minimum of 1 foot beyond the arc. Wet the side of the panel which, when hung, is in compression. Apply the amount of water as shown above with a garden sprayer. Stack panels with wet sides face to face and cover with plastic sheet. Allow to set for one hour. Install panels on the convex side of the wall first. Begin at one end of the curved surface, wrapping and fastening the panels around the framing. On the concave side of the wall, begin at the center of the curve and work out in both directions. Screw fastener spacing is 12 inches O.C. in single-layer application; 16 inches O.C. for base and 12 inches O.C. for face layer in double-layer application. Allow panels to dry for 24 hours before finishing. Finish face panel joints, internal angles and exposed fasteners with a U. S. Gypsum System applied according to manufacturer’s directions.

3.8 WORKMANSHIP TOLERANCES and REQUIRED LEVEL OF FINISH

A. Wallboard:

01 Visual: Correct any nicks, bumps, out-of-level or out-of-plumb areas detectable to the naked eye.

02 Float solid between corner beads less than 36 inches apart. Surfaces that appear concave are not acceptable.

03 Provide "J" mold and continuous 1/4 inch reveal wherever gypsum board directly abuts other material or when the end is exposed.

04 Float control joints flush with the wall surface so that ceiling wall molds that are specified separately will align flat and straight with the wall surface.

B. Required Level of Gypsum Drywall Finish (refer to Gypsum Association publications for standards):

01 All gypsum wallboard shall be finished to a level 4 unless specifically scheduled or noted otherwise. All joints and interior angles shall have tape embedded in joint compound and 2 separate coats of joint compound applied over all flat joints and 1 separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with 3 separate coats of joint compound. All joint compounds shall be smooth and free of tool marks and ridges.

02 For all plenum areas and areas not exposed provide a level 1 finish. All joints and interior angles shall have tape set in joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable.

03 All gypsum wallboard scheduled to receive a semi-gloss or glossy finish and those receiving specialty graphics shall be finished to a level 5 unless specifically scheduled or noted otherwise. All joints and interior angles shall have tape embedded in joint compound and 2 separate coats of joint compound applied over all flat joints and 1 separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with 3 separate coats of joint compound. A thin coat of joint compound or a material manufactured especially for this purpose, shall be applied to the entire surface. The surface shall be smooth and free of tool marks and ridges.

04 On all fire-rated walls, wall rating shall be stenciled above ceiling per Fire Marshall’s requirements.

3.9 COMMENCEMENT RESTRICTIONS

A. Interior gypsum wallboard and ceiling board installation may not commence until all exterior sheathing and dampproofing is completed, the individual floor is dried in or roofing is complete, roof top equipment openings are covered and flashed, and exterior wall openings are protected.

3.10 PROTECTION AND CLEAN UP

A. Coordinate with painting and make sure all gypsum board is primed and the specified texture is provided.

B. Unless the Construction Manager gives notice otherwise, in advance. Each Trade contractor is responsible for removing his own trash from the Work area and for the initial cleaning of his own Work, while ongoing and when completed.

01 Garbage collections: Provide a collection can at each location on the site used as an eating area.

02 Trash removal: Clear the building and site of trash at least once a week. When rapid accumulation occurs, make more frequent removal. Remove highly combustible trash such a paper and cardboard daily.

03 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 restrictions. No debris or material may be buried or burned at the site. Take necessary precautions to prevent accidental burning of materials be avoiding large accumulations of combustible materials.

C. The Work shall be turned over to the Construction Manager/Owner in immaculate condition. Cleaning includes removal of smudges, marks, stains, fingerprints, soil, dirt, paint spots, dust, lint, discolorations and other foreign material.

D. Remove all temporary facilities.

END OF SECTION

SECTION 09 30 13

CERAMIC TILING

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide all floor tile products / work as indicated on the Drawings and required for a complete installation.
   02 Provide all wall tile products / work as indicated on the Drawings and required for a complete installation.
   03 Provide message tile and depth marking tiles at Natatorium D101
   04 Provide other tile products / work at other locations as indicated on the Drawings and required for a complete installation.

C. Related Work:
   01 Section 03 30 00 – Cast-In-Place Concrete.
   02 Section 07 92 00 – Joint Sealants.
   03 Section 09 21 13 – Gypsum Board Assemblies.
   04 Section 09 30 16 – Quarry Tiling.
   05 Refer to other division 09 flooring specifications as required to assure proper coordination and interface at applicable locations.

1.2 SUBMITTALS

D. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

E. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

F. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.
   04 Indicate patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, setting details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

G. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.

01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
02 Generic details that do not depict actual conditions shall not be acceptable.

H. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
01 Include recommended cleaning products and instructions for use. Provide recommended cleaning methods, stain removal methods, polishes and waxes.
02 Where applicable, provide recommended maintenance schedules and procedures.

I. Color / Finish Samples:
01 Provide two (2) samples of each finish for selection by the Architect.
02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
03 Minimum size shall be 3" x 3" but must be large enough to convey attributes of the proposed product.
04 Composite Sample: Submit samples of selected tile and grout mounted on a minimum 12" x 12" board, or larger if necessary, indicating tile pattern / installation, joint size and grout color.

J. Mockup: Before installing tile, contractor to construct a mock-up for review by Owner and Architect.

K. For warranties longer than one (1) year, submit a sample of the warranty proposed to be furnished.

1.3 REFERENCES

A. American National Standards Institute:
01 ANSI A108.1 – Installation of Ceramic Tile with Portland Cement Mortar.
02 ANSI A108.4 – Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile Setting Epoxy Adhesive.
03 ANSI A108.5 – Ceramic Tile installed with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar.
04 ANSI/TCA A 108.6 – Ceramic Tile installed with Chemical Resistant, Water Cleanable Tile-Setting and Grouting Epoxy.
05 ANSI A108.10 – Grout Installation.
06 ANSI A118.1 – Dry-Set Portland Cement Mortar.
07 ANSI A118.4 – Latex Portland Cement Mortar.
08 ANSI A118.6 – Specifications for Ceramic Tile Grout.
09 ANSI A136.1 – Organic Adhesives for Installation of Ceramic Tile, Type 1 and Type 2.
10 ANSI A137.1 – Specifications for Ceramic Tile.

B. Tile Council of North America (TCNA):
01 TCNA Handbook for Ceramic, Glass, and Stone Tile Installation (latest edition).

1.4 WARRANTY

A. The tile installation, including tile products, mortar adhesives and grout, shall be complete system as recommended by the manufacturer for the specific installation.

B. Provide a complete systems warranty, issued by the tile setting manufacturer that will cover the entire tile installation system against defects for a minimum ten (10) years.

PART 2 - PRODUCTS

2.1 TILE MANUFACTURERS

A. Design is based on specific products as manufactured by Daltile, Crossville, and American Olean as indicated on the Drawings or specified below.
   01 Requests for substitutions will only be considered from the two manufacturers listed above and Daltile during the bidding / proposal phase provided all proposed products meet or exceed the specified requirements, including color.

2.2 TILE MATERIALS

A. Porcelain Floor Tile:
   01 Crossville “Argent 2.0” series
      a. Color body porcelain tile.
      b. Size(s): As indicated on interior finish legend
      c. Finish: As indicated on interior finish legend
      d. Color(s): As indicated on interior finish legend.
      e. Dynamic Coefficient of Frictions > 0.50.
      f. Patterns shall consist of borders and other patterns as indicated on Drawings.

   02 Crossville “Color Blox 2.0” series
      a. Color body porcelain tile.
      b. Size(s): As indicated on interior finish legend
      c. Finish: As indicated on interior finish legend
      d. Color(s): As indicated on interior finish legend.
      e. Dynamic Coefficient of Frictions > 0.50.
      f. Patterns shall consist of borders and other patterns as indicated on Drawings.
      g. Provide coved tile base where indicated on the Drawings.

B. Porcelain Wall Tile:
   01 Crossville “Shades” series
      a. Color body porcelain tile.
      b. Size(s): As indicated on interior finish legend
      c. Finish: As indicated on interior finish legend
      d. Color(s): As indicated on interior finish legend
      e. Patterns shall consist of borders and other patterns as indicated on Drawings.
      f. Cut tile to size indicated on drawings.
      g. Provide coved tile base where indicated on the Drawings.

   02 Crossville “Argent 2.0” series
      a. Color body porcelain tile.

b. Size(s): As indicated on interior finish legend
c. Finish: As indicated on interior finish legend
d. Color(s): As indicated on interior finish legend
e. Patterns shall consist of borders and other patterns as indicated on Drawings.
f. Cut tile to size indicated on drawings.
g. Provide coved tile base where indicated on the Drawings.

03 American Olean “Theoretical Bold” series
a. Color body porcelain tile.
b. Size(s): As indicated on interior finish legend
c. Finish: As indicated on interior finish legend
d. Color(s): As indicated on interior finish legend
e. Patterns shall consist of borders and other patterns as indicated on Drawings.
f. Cut tile to size indicated on drawings.

C. Message Tile and Depth Markings (at Natatorium D101):
01 Depth markings and warning signs shall be 6” x 6” with 4” high contrasting numbers and letters. Color to be as selected by Architect.
02 All message tile and depth markings shall have a slip resistant, matte finish.
03 Single tile abbreviations shall be used for ‘FT’ and ‘IN’.
04 Provide no diving warning signs with 6” x 6” tile displaying the international no diving symbol.
05 Minimum coefficient of friction shall be 0.6 for wet surfaces.
06 Coordinate with urethane (resinous) flooring manufacturer for tile locations.
07 Provide metal transition strip between tile and adjacent floor material.

2.3 TILE SETTING MATERIALS

A. Mortar adhesive and grout products shall be furnished by a single manufacturer; and as a system shall be eligible to provide a system warranty.

B. Acceptable Manufacturers:
01 Laticrete.
02 Ardex.
03 Mapei Americas.
04 Custom Building Products.
05 Southern Grouts and Mortars.
06 Cemix / Texrite.

C. Cement Adhesives:
01 Polymer / latex modified, Portland cement based mortar formulated for thin-set tile applications.
02 In accordance with ANSI A118.15.
03 Provide in pre-mixed bags / containers that require only the addition of water.
04 Specific mortar adhesive shall be as recommended by the manufacturer for the intended application.

D. Epoxy Tile Adhesives:
01 In accordance with ANSI A 118.3

02 Provide where indicated on the drawings, or required for setting as tile as specified by ANSI A 108.6 Chemical Resistant, Water-Cleanable Tile Setting and Grouting Epoxy.
03 Epoxy mortar shall exhibit excellent non-sag and non-slump properties.
04 Specific mortar adhesive shall be as recommended by the manufacturer for the intended application.

E. Standard Grout:
01 Polymer modified, Portland cement based, sanded grout.
02 In accordance with ANSI A118.7.
03 Suitable for 1/16” to 1/8” joint widths.
04 Color consistency throughout entire installation.
05 Contents / additives to inhibit mold and mildew formulation and growth.
06 Provide in pre-mixed bags / containers that require only the addition of water.
07 Specific grout shall be as recommended by the manufacturer for the intended application.
08 Grout color shall be as selected by the Architect from the manufacturer’s full range of color selections.

F. Epoxy Grout:
01 High performance, cement based, epoxy grout.
02 In accordance with ANSI A 118.3.
03 Suitable for 1/8” to 3/8” joint widths.
04 Color consistency throughout entire installation.
05 Contents / additives to inhibit mold and mildew formulation and growth.
06 Provide in pre-mixed bags / containers that require only the addition of water.
07 Specific grout shall be as recommended by the manufacturer for the intended application.
08 Grout color shall be as selected by the Architect from the manufacturer’s full range of color selections.

G. Joint Sealers:
01 High performance, single-compound, 100% silicone sealant formulated specifically for ceramic tile and stone applications.
02 In accordance with ASTM C920 - Standard Specification for Elastomeric Joint Sealants, Type S, Grade NS, Class 25.
03 Formulated with fungicides to resists mold and mildew growth.
04 Color consistency throughout entire installation.
05 Specific grout shall be as recommended by the manufacturer for the intended application.
06 Sealant color shall match grout color as selected by the Architect from the manufacturer’s full range of color selections.

H. Crack Isolation Membrane
01 Design is based on Mapei Mapeguard 2 or DalTile Dal-CIM 500EX or as recommended by the manufacturer.
02 Crack isolation membrane shall be included in the system warranty.

2.4 METAL TRANSITION MATERIALS

A. Design is based on products manufactured by Schluter Systems.

B. Flooring Transitions: Provide the following flooring transitions where applicable.

01 Tile to Carpet: Model Schiene
02 Tile to Sealed Concrete: Model RENO-U.
03 Tile to Urethane (Resinous) Flooring: Model Schiene

2.5 EXTRA TILE

A. Deliver extra material to Owner at Substantial Completion. Furnish extra material in the amount of three (3) unopened boxes of each color and base, and size indicated from the same tile run as installed. Label each box with school name and date installed.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examination: Examine substrates for expansion joints, cold joints and defects which may affect the work. Do not start work until defects have been corrected. Ensure that surfaces are:
   01 Dry, clean, free of oily or waxy films, free of curing compounds.
   02 Firm and level within specified tolerances.
   03 Minimum of 40°F and rising.

B. Tile contractor shall examine preparatory work by others and notify Architect of any imperfections which would affect a satisfactory completion of this tile work. Absence of such notification shall constitute acceptance of responsibility by tile contractor.

C. Verify that slab is free of cracks, waxy or oily films, and is well cured. Absence of such notification shall constitute acceptance of responsibility by tile contractor.

D. Where required for specified systems warranty, provide preparation materials in accordance with manufacturer's recommendations and installation instructions.

E. Level substrate surfaces to acceptable flatness by installing latex floor leveling material in accordance with manufacturer's instructions and/or slab grinding.

3.2 INSTALLATION

A. Unless shown otherwise on the Drawings, align joints vertically and horizontally.
   01 Where multiple tile sizes are used on the same wall / plane, arrange tiles to align common joints.

B. Use epoxy adhesive and epoxy grout at all wet locations, including, but not necessarily limited to:
   01 Restrooms
   02 Shower areas
   03 Food service areas.

C. Coordinate ceramic tile joints to align with wall expansion / control joints in CMU and framed walls.
   01 Provide non-grouted, sealed joints in ceramic tile at wall expansion / control joints.

02 At wall expansion joints that are installed with an expansion joint cover, locate ceramic tile joints as required to accommodate the expansion joint cover.

D. Lay out tile on each wall / plane so that the minimum size tile used is not less than 1/2 tile size.

E. Where partial tile is required saw-cut to provide straight, flush, smooth edges.
01 Where wall patterns indicated on the Drawings require cut tile (i.e. rotated accent tile, and similar), ease the edges of saw-cut tile.

F. Provide preformed inside and outside corner tile units where applicable.

G. Bullnose Tile Locations:
01 Provide bullnose edged tile at the top course of tile that does not extend full height to ceilings.
02 Provide bullnose edged tile at the bottom course of tile that directly above seamless epoxy flooring bases.

H. Set interior wall tile in accordance with TCNA Spec. W242-19 for gypsum board substrate. Set interior wall tile on CMU in accordance with TCNA Spec. W211-18.

I. Set floor tile and grout in accordance with TCNA Spec. F112-08. (Allow a minimum of 24 hours after tiles is set before grouting.) Slope tile within three (3) foot diameter of floor drains.

J. Form internal angles square.

K. Install expansion joints in accordance with TCNA Publication EJ171-18.
01 Provide expansion joints at maximum 24’-0” O.C., and more often if recommended by the manufacturer for the specific installation.
02 Additionally, align ceramic tile joints to coordinate with wall expansion / control joints.

L. Joint Sealers:
01 Provide at all inside corners of intersecting tiled walls.
02 Provide at all tiled terminations adjacent to door frames and other built-in assemblies.
03 Sealed joints shall be non-grouted, and sealed continuous.

M. Sound tile after setting. Replace hollow sounding units.

N. Install transition strips at locations where floor tile meets other material(s).

O. Clean all tile surfaces upon completion of tile work, prior to installing plumbing fixtures. Protect finish tile work as required from damage by other trades / activities.

END OF SECTION

SECTION 09 30 16

QUARRY TILING

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work: provide all quarry tile flooring as indicated on the Drawings
   01 Provide all quarry tile floor products / work as indicated on the Drawings and required for a complete installation.
   02 Provide all quarry tile base products / work as indicated on the Drawings and required for a complete installation.
   03 Provide other quarry tile setting and sealing products as required for a complete installation.

C. Related Work:
   01 Section 03 30 00 – Cast-In-Place Concrete.
   02 Section 09 30 13 – Ceramic Tiling.

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.
   04 Indicate patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, setting details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01 Include recommended cleaning products and instructions for use. Provide recommended cleaning methods, stain removal methods, polishes and waxes.
   02 Where applicable, provide recommended maintenance schedules and procedures.

F. Color / Finish Samples:
   01 Provide two (2) samples of each finish for selection by the Architect.
   02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
   03 Minimum size shall be 3" x 3" but must be large enough to convey attributes of the proposed product.
   04 Composite Sample: Submit samples of selected tile and grout mounted on a minimum 12" x 12" board, or larger if necessary, indicating tile pattern / installation, joint size and grout color.

G. Mockup: Before installing tile, contractor to construct a mock-up for review by Owner and Architect.

H. For warranties longer than one (1) year, submit a sample of the warranty proposed to be furnished.

1.3 REFERENCES

A. American National Standards Institute (ASNI):
   01 ANSI A108 Series: Specifications for Installation of Ceramic Tile and Dimensional Tile.
   02 ANSI A 108.1A – Specifications for Installation of Ceramic Tile in the Wet Set Method.
   03 ANSI A 108.10 – Load Bearing, Bonded, Waterproof Membranes for ThinSet Ceramic and Dimensional Tile.
   04 ANSI A118 Series – Specifications for Ceramic Tile Mortars and Grouts.
   05 ANSI A 136.1 – Organic Adhesives for Installation of Ceramic Tile.
   06 ANSI A 137.1 – Specifications for Ceramic Tile.

B. American Society for Testing and Materials (ASTM):
   01 ASTM C499 – Facial Dimensions and Thicknesses of Flat, Rectangular Tile by the Taber Abraser.
   02 ASTM C501 – Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser.
   03 ASTM C1028 - Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Tile Like Surfaces by the Horizontal Dynamometer Pull Meter Method.

C. Tile Council of North America (TCNA):
   01 TCNA Handbook for Ceramic, Glass, and Stone Tile Installation (latest edition).

1.4 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: Tile on walkway surfaces shall be provided with the following values as determined by testing in conformance with ASTM C 1028.
   01 Level Surfaces: Minimum of 0.6 (Wet).
   02 Step Treads: Minimum of 0.6 (Wet).
   03 Ramp Surfaces: Minimum of 0.8 (Wet).

1.5 WARRANTY

A. The tile installation, including tile products, mortar adhesives and grout, shall be complete system as recommended by the manufacturer for the specific installation.

B. Provide a complete systems warranty, issued by the tile setting manufacturer that will cover the entire tile installation system against defects for a minimum five (5) years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Design is based on specific products, finishes and colors as manufactured by Daltile as identified on the Drawings.
   01 Substitutions will only be considered prior to bid if the proposed substitution is a match to the specific product(s) identified on the Drawings as approved by the Architect.
   02 Refer to specification Section 00 AF – Subcontractor / Manufacturer Prequalification and AB – Instructions to Offers for substitution requirements.

B. The following manufacturers are acceptable provided the products proposed for use are equal to the basis of design products, including color if specific products as identified on the Drawings and / or finish schedules.
   01 American Olean Tile Co., Sure-Step.
   02 Metropolitan Ceramics, Metrotread
   03 Summitville Tiles, Inc.

2.2 QUARRY TILE MATERIALS

A. Quarry tile shall be Daltile Quarry Tile
   01 Field Tile: 6" x 6".
   02 Coved Base: 5” x 6”.
   03 Finish: Textured
   04 Color(s) as indicated on the Drawings.

2.3 QUARRY TILE SETTING MATERIALS

A. Organic Adhesive: ANSI A136.1, thinset bond type; use Type I in areas subject to prolonged moisture exposure.

B. Epoxy Adhesive: ANSI A118.3, thinset bond type.

C. Mortar Bed Materials:
   01 Portland cement: ASTM C150, type 1, gray or white.
   02 Hydrated Lime: ASTM C207, Type S.
   03 Sand: ASTM C144, fine.

04 Latex additive: As approved.
05 Water: Clean and potable.

D. Mortar Bond Coat Materials:
01 Dry-Set Portland Cement type: ANSI A118.1.
02 Latex-Portland Cement type: ANSI A118.4.
03 Epoxy: ANSI A118.3, 100 percent solids.

E. Epoxy Grout: ANSI A118.3, 100 percent solids epoxy grout; color as selected.

F. Silicone Sealant:
01 Silicone sealant, moisture and mildew resistant type, white; use for shower floors and shower walls.
02 Sealant shall have a T Rating suitable for heavy traffic.

G. Cleavage Membrane (as recommended by the tile manufacturer for the specific installation).
01 Asphalt Saturated Felt, 15 LB, conforming to ASTM D226, Type 1.
02 Polyethylene Film, minimum 4 Mil thickness, conforming to ASTM D4397.

H. Mortar shall be acid resistant.

I. Epoxy grout shall conform to ANSI A118.3. Color as selected by Architect.

J. Design of quarry tile sealer is based on Mapei Ultracare Penetrating Plus Tile Stone and Grout Sealer or as recoomended by the manufacturer.
01 Quarry tile sealer shall be included in the system warranty.

K. Extra Tile: Deliver extra material to Owner. Furnish extra material in the amount of three (3) unopened boxes of each color and base, and size indicated from the same tile run as installed. Label each box with school name and date installed.

2.4 METAL TRANISITION MATERIALS

A. Design is based on products manufactured by Schluter Systems.

B. Flooring Transitions: Provide the following flooring transitions where applicable.
01 Tile to Carpet: Model Schiene
02 Tile to Sealed Concrete: Model RENO-U.

PART 1 - EXECUTION

3.1 EXAMINATION

A. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.

B. Verify that required floor-mounted utilities are in correct location.

C. Note all cold joint locations and verify correct installation at these areas.

D. Tile contractor shall examine preparatory work by others and notify Architect of any imperfections which would affect a satisfactory completion of this tile work. Absence of such notification shall constitute acceptance of responsibility by tile contractor.

3.2 PREPARATION

A. Protect surrounding work from damage.

B. Remove any curing compounds or other contaminates.

C. Vacuum clean surfaces and damp clean.

D. Seal substrate surface cracks with filler. Level existing substrate surfaces by installing latex floor leveling material in accordance with manufacturer's instruction and/or slab grinding to acceptable flatness tolerances.

3.3 INSTALLATION – FLOORS – MORTAR BED METHOD

A. General:
   01 Comply with ANSI A108.1, ANSI A108.2, and the "Handbook for Ceramic Tile Installation" of the Tile Council of America. TCNA Spec F114.
   02 Maintain minimum temperature limits and installation practices recommended by materials manufacturers.

B. Over interior concrete substrates install in accordance with TCNA Handbook Method F111, with cleavage membrane, unless otherwise indicated.

C. Cleavage Membrane: install in accordance with TCNA Handbook Method F121.
   01 Lap edges and ends.

D. Mortar Bed Thickness: 1-1/4 to 2 inch (32 to 51 mm) maximum, unless otherwise indicated.

E. Epoxy Grout: install in accordance with TCNA Handbook Method F132, bonded.

F. Limits of Tile:
   01 Extend tile into recesses and under equipment and fixtures to form a complete covering without interruptions.
   02 Terminate tile neatly at obstructions, edges, and corners, without disruption of pattern or joint alignment.

G. Joining Pattern:
   01 Lay tile in grid pattern.
   02 Align joints when adjoining tiles on floor and base are the same size.
   03 Layout tile work and center the tile fields both directions in each space.
   04 Adjust to minimize tile cutting. Minimum tile size used is 1/2 size.

H. Install expansion and control joints in accordance with TCNA Publication EJ-171.
   01 Keep expansion joints free of adhesive or grout.
   02 Apply sealant to joints.

I. Accurately cut and fit tile to penetrations through tile, leaving sealant joint space.

J. Form corners and bases neatly. Align floor joints.

K. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size.

Make joints watertight, without voids, cracks, excess mortar, or excess grout.

L. Install in strict accordance with tile manufacturers installation instructions and recommendations for the specific installation.

M. Install thresholds where indicated.

N. Sound tile after setting. Replace hollow sounding units.

O. Allow tile to set for a minimum of 48 hours prior to grouting.

P. Grout tile joints. Use epoxy grout unless otherwise indicated.

Q. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

R. Slope tile within three (3) foot diameter of a floor drain.

S. Install transition strips at locations where floor tile meets other material(s).

3.4 CLEANING AND PROTECTION

A. Cleaning:

01 Upon completion of placing and grouting and before installing plumbing fixtures or equipment, clean the work of this Section in accordance with recommendations of the manufacturers of the materials used.

02 Protect surfaces from effects of acid cleaning.

03 Flush surfaces with clean water before and after cleaning.

B. Provide tile surfaces clean and free from cracked, broken, chipped, unbound, and otherwise defective units.

C. Provide required protection of tile surfaces to prevent damage and wear prior to acceptance of the work by the Owner.

D. The Contractor shall replace any tiles damaged or stained during the construction process.

END OF SECTION

SECTION 09 51 13

ACOUSTICAL TILE CEILINGS

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Ceiling suspension system.
   02 Acoustical, vinyl covered gypsum board and / or wood ceiling tiles as indicated or scheduled on the Drawings.
   03 Fire protection over light fixtures and other ceiling mounted items as required to meet UL designs for fire rated ceiling assemblies.

C. Related Work:
   01 Section 01 11 23 – Codes
   02 Section 09 21 16 – Gypsum Board Assemblies.
   03 Section 09 84 36 – Sound-Absorbing Ceiling Units, Acoustical Wall Panels, Fabrics, and Diffusers

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.
   04 Provide calculations demonstrating compliance with wind load and other requirements.
   05 Shop drawings shall be sealed and signed by a Texas registered engineer.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01 Include recommended cleaning products and instructions for use.
   02 Where applicable, provide recommended maintenance schedules and procedures.

F. Color / Finish Samples:
   01 Provide two (2) samples of each finish for suspension grid and ceiling tile for selection by the Architect.
   02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
   03 Minimum size shall be 4" x 4" for acoustical tile, and minimum 8" length of suspension grid; but must be large enough to convey attributes of the proposed product.

1.3 REFERENCES

A. ASTM International (ASTM):
   01 ASTM A641/A641M-09a - Zinc-coated (Galvanized) Carbon Steel Wire.
   02 ASTM A653/A653M-15e1 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-Dip Process.
   03 ASTM C423-09a - Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
   04 ASTM C634-13 - Terminology Relating to Environmental Acoustics.
   05 ASTM C635/C635M-13a - Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
   06 ASTM C636/C636M-13 - Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
   07 ASTM C1396 – Standard Specification for Gypsum Board.
   08 ASTM D1779-98 - Adhesive for Acoustical Materials.
   09 ASTM E84-15b - Surface Burning Characteristics of Building Materials.
   10 ASTM E119-16 - Fire Tests of Building Construction and Materials.
   11 ASTM E413-16 - Classification for Rating Sound Insulation.
   12 ASTM E580/E580M-14 - Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions.
   13 ASTM E1264-14 - Classification for Acoustical Ceiling Products.

B. Underwriters Laboratory (UL):
   01 Underwriters Laboratory (UL) assemblies as required for the Work.
   02 Refer to the Drawings and other Specification sections for locations, UL Designs and requirements for fire rated assemblies.

1.4 QUALITY ASSURANCE

A. Projection Conditions:
   01 Do not install acoustical ceiling until building is enclosed, sufficient heat is provided, dust generating activities have terminated and overhead mechanical work is completed, tested and approved.
   02 Maintain temperature at minimum 60 degrees F° and humidity if 40% to 50% prior to, during, and after installation.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Design of Acoustical Tile Ceilings is based on the following products / manufacturers:
   01 Suspension System: Armstrong World Industries.
   02 Acoustical Tiles: Armstrong World Industries.
   03 Wood Ceiling Tiles: Armstrong World Industries.
   04 Ceiling Cloud Trim: Armstrong World Industries.
   05 Gypsum Board Ceiling Tiles: National Gypsum Company.
   06 Suspension Clips: Nitroset Solid Propellant Fastening System.
   07 Lay-In Sound Diffusers and Reflectors: Kinetics Noise Control.
   08 Flexible Wall Angles: Trim-Tex.

B. The following manufacturers are acceptable for use for this Section, provided all specified requirements are met or exceeded.
   01 Donn Products, Inc.
   02 USG.
   03 Rockwool International
   04 CertainTeed.
   05 Conwed.
   06 Acoustical Solutions - Lay-In Sound Diffusers and Reflectors.

2.2 SUSPENSION SYSTEMS

A. Suspension System – Non-Fire-Rated Assemblies – Type “A”:
   01 Design is based on Armstrong “Prelude ML” Exposed Tee suspension system.
   02 Cross Section: 1-1/2” x 15/16”.
   03 Standard hot-dipped galvanized steel (ASTM C635).
   04 Finish: Factory Pre-Painted - baked polyester.
   05 Typical Color: Low sheen satin - White.
   06 Non-Typical Color: Low sheen satin – Black. To be used at dark rooms, black-box theaters and other locations as indicated on the Drawings.
   07 Provide 9/16” x 15/16” angle molding at interface of all vertical walls. Material to match primary suspension system material(s).

B. Suspension System –Fire-Rated Assemblies – Type “A”:
   01 Design is based on Armstrong “Prelude XL Fire Guard” Exposed Tee suspension system.
   02 Cross Section: 1-1/2” x 15/16”.
   03 Standard hot-dipped galvanized steel (ASTM C635).
   04 Finish: Factory Pre-Painted - baked polyester.
   05 Typical Color: Low sheen satin - White.
   06 Non-Typical Color: Low sheen satin – Black. To be used at dark rooms, black-box theaters and other locations as indicated on the Drawings.
   07 Provide 9/16” x 15/16” angle molding at interface of all vertical walls. Material to match primary suspension system material(s).
   08 Provide UL approved hold down clips where required by UL Design(s).

C. Suspension System – Semi-Wet Areas – Type “B”:
   01 Same as suspension systems described above for Type “A”; with aluminum cap.

02 Provide at restrooms, mechanical rooms, and similar locations.
03 Verify locations required to be part of a fire-rated assembly.

D. Suspension System –Wet Areas and Exterior Locations – Type C:
01 Design is based on Armstrong “AL Prelude Plus XL” Exposed Tee suspension system.
02 Provide at locker rooms, shower rooms, food service areas, and exterior locations.
03 Cross Section: 1-1/2” x 15/16”.
04 Aluminum with aluminum cap.
05 Finish: Factory Pre-Painted - baked polyester.
06 Typical Color: Low sheen satin - White.
07 Provide 9/16” x 15/16” angle molding at interface of all vertical walls. Material to match primary suspension system material(s).

2.3 LAY-IN TILES

A. Acoustical Lay-In Tiles – Ceiling Type A:
01 Design is based on Armstrong “Cortega” acoustical ceiling tile.
02 Armstrong no. 770, square edge.
03 Size: 24” x 24” x 5/8”.
04 Typical Color: White.
05 At non-fire-rated assemblies: Fire Resistive
06 At fire-rated assemblies: UL Class A, suitable for use in rated assemblies
07 Humidity/Sag resistance: Standard.
08 Minimum NRC: 0.55.
09 Minimum CAC: 33 dB
10 Minimum Light Reflectance: 80%.
11 Use at Corridors and Storage rooms

B. Acoustical Lay-In Tiles – Ceiling Type B:
01 Design is based on Armstrong “Clean Room VL” acoustical ceiling tile.
02 Armstrong no. 868, square edge, unperforated.
03 Size: 24” x 24” x 5/8”.
04 Typical Color: White.
05 At non-fire-rated assemblies: Fire Resistive
06 At fire-rated assemblies: UL Class A, suitable for use in rated assemblies
07 Humidity/Sag resistance: HumiGuard Plus.
08 Mold and Mildew Resistance: BioBlock
09 Minimum NRC: 0.55.
10 Minimum CAC: 40 dB
11 Minimum Light Reflectance: 80%.
12 Use at Kitchen/food preparation areas and at Press box.

C. Acoustical Lay-In Tiles – Ceiling Type C:
01 Design is based on Armstrong “School Zone” Fine Fissured High NRC acoustical ceiling tile.
02 Square edge.
03 Size: 24” x 24” x 9/16”.
04 Typical Color: White.
05 At non-fire-rated assemblies: Fire Resistive
01 Non-Typical Color: Low sheen satin – Black. To be used at black-box theater(s); and other locations as indicated on the Drawings.

06 At fire-rated assemblies: UL Class A, suitable for use in rated assemblies
07 Humidity/Sag resistance: HumiGuard+
08 Mold and Mildew Resistance: BioBlock
09 Minimum NRC: 0.70.
10 Minimum Light Reflectance: 82%.
11 Use at Classrooms/Learning Spaces, Library, Cafeteria, Offices, Choir, Rehearsal, Orchestra and associated Practice and Ensemble Rooms, black box theater and where indicated on drawings.
12 If room is not listed under ceiling tile types A, B, and D and is not indicated on drawings, type C tiles shall be used.

D. Acoustical Lay-In Tiles – Ceiling Type D:
01 Design is based on Armstrong “Painted Nubby” High NRC acoustical ceiling tile.
02 Square edge.
03 Size: 24” x 24” x 15/16”.
04 Typical Color: White.
05 At non-fire-rated assemblies: Fire Resistive
06 At fire-rated assemblies: UL Class A, suitable for use in rated assemblies
07 Humidity/Sag resistance: HumiGuard+
08 Mold and Mildew Resistance: BioBlock
09 Minimum NRC: 0.95.
10 Minimum Light Reflectance: 82%.
11 Use at Music Areas – Band, Band Practice, Band Ensemble and where indicated on drawings.

2.4 OTHER PRODUCTS

A. Suspension Wire:
01 12-gauge solid, galvanized steel wire in lengths as required to overhead structural elements for the installation of each specific room / area.
02 Maximum Spacing: at 4'-0” O.C. both directions, wrapped tightly at least 3 full turns.
03 Provide a separate hanger wire at each corner of all lay-in light fixtures.
04 Verify and adhere to additional hanger and spacing conditions as required by provisions of Division 26 – Electrical, and UL Designs for rated assemblies.

B. Suspension Clips:
01 Design is based on Nitroset Solid Propellant Fastening System; CLU222.
02 Configuration: Utility Clip Assembly.
03 Minimum Size: 7/8” shank length; 1/8” shank diameter.
04 Allowable Loads (based on 4000 PSI concrete) at 3/4" embedment depth:
a. Tension: 120 lb.ft.
b. Shear: 165 lb.ft.
c. 45-Degree: 120 lb.ft.
05 Provide where structural conditions do not facilitate suspension wire fastening directly to steel structure.

06 Fastening to Metal Decks: Allowable only at deck valleys where a minimum of 2-1/2” depth of concrete is present.

C. Retention Clips:
01 Design of retention clips is based on Armstrong World Industries No. 414 Retention Clip; or equal accepted by the Architect.
02 Provide at locations indicated on the Drawings and / or required by specified UL design.

D. Shadow Molding:
01 Design is based on USG / Donn MS-174 Shadow Molding.
02 “W” shaped molding producing a 3/8” x 3/8” reveal.
03 Provide at all conditions where lay-in ceilings interface with gyp board ceilings in the same plane.

E. Fixture Covers: Where ceilings are part of a fire-rated assembly and required by the UL design, provide UL conforming acoustical tile covers at light fixtures, and other fixtures / equipment installed through the ceiling plane.

2.5 EXTRA STOCK

A. Deliver 2% of each type of installed ceiling board at Substantial Completion to location as directed by Owner.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ensure that walls are flat and wall corners square. Commencing work shall be construed as acceptance of preceding work performed by others, as suitable to receive work specified in this Section.
01 Ceiling wall angles shall be flush with substrate.
02 Maximum deviation from flush shall be 1/16”.

B. Where suspended ceilings interface flush with other work (window / door heads, fur-downs, etc.) verify interfacing work is at correct elevation and suitable for a flush interface.
01 Do not manipulate ceiling system to adapt to con-conforming work.

C. Ensure that wall control joints are flat and will not cause wall mold to misalign at those locations.

D. Do not install any ceiling tile until all above ceiling inspections and corrections have been completed.

E. Preliminary Layout
01 Ceiling grid layouts shown on the Drawings are generalized layouts and may not accurately depict as-built conditions.
02 Ceiling grids shall be centered within each room / area such that tile cuts at perimeter walls shall be not less than a half-tile or 12”, whichever is less.
03 Prior to commencing work coordinate with Architect in field to resolve layout in rooms / areas that do not adhere to the above requirement.
04 Do not proceed within a room / area until discrepancy(s) have been fully resolved.

3.2 SUSPENDED CEILING SYSTEMS

A. General:
   01 All suspension systems shall be attached to building structure; or other suitable framing specifically approved by the Architect.
   02 Attaching suspensions systems to the following shall not be permitted:
      a. Ductwork or HVAC equipment
      b. Electrical conduit or fixtures.
      c. Plumbing piping.
   03 Verify ceilings can be installed at heights indicated or scheduled on the Drawings. Coordinate with Architect to resolve conflicts that preclude mounting at the heights indicated.
   04 Ceilings shall be installed level, within a tolerance of 1/8” per 10’-0”, non-cumulative; unless clearly shown to be sloped on the Drawings..

B. Suspension Wires:
   01 The intent of this specification is for the suspension wires to be wrapped around primary or secondary structural steel components where ever practical. Suspension from bridging is not permitted.
   02 Suspension wires shall be wrapped over structural steel components and twisted a minimum of 3 times (1080 degrees).
   03 Maximum suspension wire may be angled up to a maximum of 45 degrees.

C. Suspension Clips:
   01 Suspension clips shall be permitted only where structural steel components do not permit installation per the paragraph above.
   02 Architect must approve all locations where suspension clips are proposed to be fastened to metal floor or roof deck.
   03 All connections to metal decks shall be made at the valley configuration of the metal deck surfaces.
   04 Connection to horizontal valley surfaces of the metal deck shall be minimized; and connections shall be at the angled walls of the deck valleys.
   05 Install suspension clips in strict accordance with manufacturer’s standards and recommendations, using manufacturer’s equipment specifically designed for the purpose.

D. Attachment of grid members to wall molding with pop rivets is not permitted.
   01 Hanger wire at 45 degrees, approximately 10 inches long may be used to tie the grid to the wall above the ceiling to prevent eventual disengagement of the two components.

E. Install ceiling systems by skilled workmen in accordance with manufacturer's printed instructions, the reviewed shop drawings and reflected ceiling plans.
   01 Exposed surfaces of acoustical units shall be level and flush, with all joints straight and true.
   02 Cutting and fitting around all items protruding through acoustical ceiling shall be done neatly.
   03 Wall angles and edge moldings shall have flush hairline joints, with all corners mitered.
   04 Where indicated or required, install retention clips at sides of acoustical panels in accordance with manufacturer’s standards and instructions.

F. Align beams or tees with angle molding at corners, unless authorized by Architect.

G. Fixture Covers:
   01 At required locations, install fixture covers at all light fixtures and other required fixtures / equipment installed in the ceiling grid.
   02 Installation shall conform to the specified UL design with respect to configuration, assembly and installation.

END OF SECTION

SECTION 09 61 43

CONCRETE FLOOR SEALER

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide concrete sealer at all interior rooms / areas designated as sealed concrete on finish schedule(s).

C. Related Work:
   01 Section 03 30 00 – Cast-In-Place Concrete

1.2 SUBMITTALS

A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

D. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01 Include recommended cleaning products and instructions for use.
   02 Where applicable, provide recommended maintenance schedules and procedures.

1.3 QUALITY ASSURANCE

A. Installer Qualifications:
   01 Company experienced in performing specified work similar in design and scope of this project; with a record of successful in-service performance. Company with sufficient production capability, facilities, and personnel to produce specified work.

B. Coefficient of Friction:

01 Achieve following coefficient of friction by field quality control testing in accordance to the following standards:
   a. ANSI B101.1 Static Coefficient of Friction – achieve a min. of .42 for level floor surfaces
   b. ANSI B101.3 Dynamic Coefficient of Friction – achieve a min. of .35 for level floor surfaces

C. Field Mock-up: Before performing work, provide the following field mock-up to verify selections made under submittals and to demonstrate aesthetic effects of sealing. Approval does not constitute approval of deviations from the Contract Documents, unless Architect specifically approves deviations in writing.
   01 Ten-foot square field mock-up shall be representative of work
   02 Perform preparation and sealing work as scheduled using the same personnel as will perform work for the project.
   03 Approval is for the following aesthetic qualities:
      a. Compliance with approved submittals
      b. Compliance with specified finished gloss level
   04 Obtain Architect's approval before starting work on the project.
   05 Protect and maintain approved field mock-ups during construction in an undisturbed condition as a standard for judging completed work.

PART 2 - PRODUCT

2.1 MANUFACTURERS

A. Design is based on products manufactured by Prosoco.

B. Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this Section, provide all proposed products meet or exceed the specified requirements.
   01 Euclid Chemical
   02 L.M. Scofield
   03 ZEP Manufacturing

2.2 MATERIALS

A. Design of concrete floor sealer for new concrete is based on Prosoco Consolideck LS/CS.

01	Specific Gravity:	1.05
02	pH:	11.0
03	Total Solids:	6%
04	Wt./Gal.:	8.6 lbs
05	Flash Point:	Not applicable
06	Freeze Point:	32°F
07	VOC Content:	0 g/L

B. Design of concrete floor sealer for existing concrete is based on Prosoco Consolideck LS.

01	Specific Gravity:	1.10
02	pH:	11.0
03	Total Solids:	14.5%
04	Wt./Gal.:	9.2 lbs
05	Flash Point:	Not applicable
06	Freeze Point:	32°F

07 VOC Content: 0 g/L

2.3 ACCESSORIES

A. Control Joint Filler: Metzer McGuire to match concrete color. Fill all joints whether indicated on drawings or not.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Concrete slabs shall be smooth, dry, free of any foreign materials, and must wet uniformly.

B. Apply one coat of specified finish in strict accordance with manufacturer's instructions. Do not allow excess material to puddle on the floor.

C. Install coating after all painting operations are completed.

END OF SECTION

SECTION 09 61 44

POLISHED CONCRETE (REACTIVE CHEMICAL CONCRETE STAIN)

CONDITIONS OF THE CONTRACT, SUPPLEMENTARY CONDITIONS AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB - Instructions to Proposers and Section AF – Subcontractor and Manufacturer Prequalification for substitutions.

B. Scope of Work:
   01 Provide polished concrete at all interior rooms/areas scheduled as polished concrete.
   02 All areas scheduled to have polished concrete shall be stained.

C. Summary:
   01 Section includes products and procedures for preparing, acid staining and sealing concrete floors

1.2 SUBMITTALS

A. Provide all submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Maintenance Data for inclusion in O&M manual required.
   01 Instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
   02 Include precautions against cleaning products and methods that may be detrimental to finishes and performance.

C. Product Data
   01 Provide product data for all stains, hardeners, densifiers, sealers and chemical required to produce the finished concrete floor.

D. Stain Samples:
   01 Submit full range of manufacturer’s stain colors available for selection by Architect.
   02 Provide mockup of multiple color selections at request of Architect or Owner to confirm color selection.

1.3 QUALITY ASSURANCE

A. Installer Qualifications:
   01 Company experienced in performing specified work similar in design and scope of this project; with a record of successful in-service performance. Company with sufficient production capability, facilities, and personnel to produce specified work.
   Company must carry Diamatic certification for the application of chemicals and the usage of equipment required to carry out the scope of work.

B. Coefficient of Friction:
   01 Achieve following coefficient of friction by field quality control testing in accordance to the following standards:
      a. ANSI B101.1 Static Coefficient of Friction – achieve a min. of .42 for level floor surfaces
      b. ANSI B101.3 Dynamic Coefficient of Friction – achieve a min. of .35 for level floor surfaces

C. Field Mock-Up – before performing work, provide the following field mock-up to verify selections made under submittals and to demonstrate aesthetic effects of color and sealing. Approval does not constitute approval of deviations from the Contract Documents, unless Architect specifically approves deviations in writing. Ten foot square field mock-up shall be representative of work
   01 Perform preparation, acid staining and sealing work as schedule using the same personnel as will perform work for the project.
   02 Approval is for the following aesthetic qualities:
      a. Compliance with approved submittals
      b. Compliance with specified finished gloss level
      c. Compliance with specified color
   03 Obtain Architect's approval before starting work on the project.
   04 Protect and maintain approved field mock-ups during construction in an undisturbed condition as a standard for judging completed work.

1.4 FIELD CONDITIONS

A. Damage and Stain Prevention – General Contractor to take precautions to prevent damage and staining of concrete surfaces to be finished.
   01 Prohibit the use of markers, spray paint, soapstone, liquid membrane film forming curing compounds, and pipe-cutting operations over the concrete surface. Prohibit of storage of any items over concrete surfaces for not less than 28 days after concrete placement.
   02 Prohibit ferrous metals storage over concrete surfaces.
   03 Protect from petroleum, oil, hydraulic fluid or other liquid dripping from equipment working over concrete surfaces. Protect concrete from acids and acidic agents, and from painting activities over the concrete surfaces.

B. Environmental Limitations – Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation and other conditions affecting the liquid applied products required for this installation.

PART 2 - PRODUCT

2.1 MANUFACTURERS

A. Liquid Applied Products - Acceptable Manufacturers:
   01 Liquid Densifier: Prosoco LS Lithium Silicate or prior approved alternate
   02 Stain: Kemico Stone Tone Acid Stain or prior approved alternate. Provide full range of colors for selection by Architect.
   03 Sealer –Stain Protection: Prosoco LS Guard or prior approved alternate

2.2 ACCESSORIES

A. Joint Filler – Metzer McGuire to match GemTone Stain color or prior-approved alternate.

B. Repair Material:
   01 Metzger McGuire Rapid Refloor – for minor crack repair less than 1/8”
   02 Metzger McGuire Spall Pro-RS88 – for cracks and spalls in excess of 1/8”
   03 Other products designed to repair cracks and surface imperfections – must have sufficient bonding capabilities to adhere after the polishing to the concrete surface and provide abrasion resistance equal to or greater than the surrounding concrete substrate.

2.3 POLISHING AND ENGRAVING EQUIPMENT

A. Field Grinding and Polishing Equipment:
   01 Diamatic 780 multiple head, counter rotating, walk behind planetary grinder
   02 Diamatic 3140 dust extraction equipment, required when grinding, honing and polishing.

B. Edge Grinding and Polishing Equipment:
   01 Hand-held or walk behind machines producing the same results without noticeable difference, as field grinding and polishing equipment.

C. Burnishing Equipment:
   01 High sped walk behind or ride-on machines capable of generating 1000 to 2000 revolutions per minute and with sufficient head pressure of not less than 20 pounds to raise floor temperature by 20 degrees F.

D. Diamond Tooling:
   01 Abrasive tools that contain industrial grade diamonds within a bonded matrix (such as metallic, resinous, ceramic, etc.) that are attached to rotating heads to refine the concrete substrate. Utilize the appropriate tooling as follows to achieve the desired result:
      a. Bonded abrasive
      b. Metal bond tooling
      c. Hybrid tooling
      d. Transitional tooling
      e. Resin bond tooling
      f. Abrasive pads

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:
   01 Once it is exposed, examine substrates to be polished for compliance with requirements and other conditions affecting performance. Notify Contractor and Architect of any conditions that will cause the finished product to deviate from the mockup area.

B. Proceed only when satisfied that the result will be consistent with the mockup area, or the finished result expectation is adjusted with the Architect.

C. The start of work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

A. Cleaning Concrete Surfaces:
   01 Prepare and clean concrete surfaces.
   02 Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, paint splatter, and other contaminants incompatible with liquid applied products and polishing.

3.3 COLORING CONRETE FLOORS

A. Stain or Pigmented Micro Stain Application
   01 All polished concrete to be stained unless indicated otherwise on drawings.
   02 Apply solution by methods and techniques required by manufacturer to produce finish matching approved field mockups.
   03 Maintain wet edge, working newly applied solution into edges of adjacent wet edges of previously treated surfaces.
   04 Maintain consistent saturation throughout the application.
   05 Avoid splashing, dripping or puddling of solution on adjacent substrates.
   06 Apply 2 coats of stain. Allow to completely dry after each coat. Do not scrub clean between coats.
   07 After the final coat of chemical stain has remained on the surface for a minimum of 4 hours, neutralize unreacted chemical stain residue and then remove completely prior to sealing (rinsing). After neutralization, thoroughly rinse surface with clean water several times to remove soluble salts. While rinsing, lightly abrade surface using a low-speed floor machine and red pad to remove residue and weakened surface material. Runoff may stain the adjacent areas or harm plants. Collect rinse water by wet vacuuming or absorbing with an inert material.
   08 Failure to completely remove all residue prior to sealing the surface will cause appearance defects, adhesion loss or peeing, reduced durability, and possible bonding failure and delamination of sealer.
   09 All stain residue, runoff liquid, and rinse water must be collected and disposed of according to applicable federal regulations.
   10 When color matches approved mockups, neutralize as required by manufacturer.

3.4 POLISHING CONCRETE FLOORS

A. Preform all polishing procedures to ensure a consistent appearance from wall to wall.

B. Initial Grinding:
   01 Use grinding equipment with metal or semi-metal bonded tooling.
   02 Begin grinding in one direction using sufficient size equipment and diamond tooling to meet specified aggregate exposure class.
   03 Make sequential posses with each pass perpendicular to pervious pass using finer grit tool with each pass, up to 100 grit metal bonded tooling.
   04 Achieve maximum refinement with each pass before proceeding to finer grit tools.

05 Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.

06 Continue grinding until aggregate exposure matches approved field mockups.

C. Treating Surface Imperfections:

01 Mix patching compound or grout material with dust created by grinding operations, manufacturer's tint, or sand to match color of adjacent concrete surfaces.

02 Fill surface imperfections including, but not limited to, holes, surface damage, small and micro cracks, air holes, pop-outs, and voids with grout to eliminate micro pitting in finished work.

03 Work compound and treatment until color differences between concrete surface and filled surface imperfections are not reasonably noticeable when viewed from 10 feet away under lighting conditions that will be present after construction.

D. Liquid Densifier Application:

01 Apply undiluted to point of rejection, remove excess liquid and allow curing according to manufacturer's instructions.

E. Honing:

01 Use grinding equipment with hybrid or resin bonded tooling.

02 Hone concrete in one direction starting with a 50 grit tooling and make as many sequential passes as required to remove scratches, each pass perpendicular to previous pass up to 100 grit tooling reaching maximum refinement with each pass before proceeding to finer grit tooling.

03 Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.

F. Polishing:

01 Use polishing equipment with resin-bonded tooling.

02 Begin polishing in one direction starting with 200 grit tooling.

03 Make sequential passes with each pass perpendicular to previous pass using finer grit tooling with each pass until the specified level of glass has been achieved. Achieve maximum refinement with each pass before proceeding to finer grit pads.

04 Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.

05 Stain Protection – uniformly apply and remove excessive liquid according to manufacturer's instructions. Final film thickness should be less than .05mils after cure.

06 Final Polish – using burnishing equipment and finest grit abrasive pads, burnish to uniform reflective sheen matching approved field mockup.

G. Final Polished Concrete Floor Finish:

01 Aggregate exposure for renovated spaces will be determined by the steps incorporated in this specification coupled with the aggregate placement in the existing substrate.

02 Finished Gloss Level 2 – Medium Glass appearance

a. Procedure – recommend not less than 3 steps with full refinement of each diamond tool with 1 applications of densifier.

b. Gloss measurement – determine the specular gloss by incorporating the Reflective Sheen Reading of not less than 20 according to ASTM D523 prior to the application of sealers.

3.5 FIELD QUALITY CONTROL

A. For Field Testing, engage a qualified walkway auditor to perform field testing to determine if polished concrete floor finish complies with specified coefficient of friction
   01 ANSI B101.1 for static coefficient of friction
   02 ANSI B101.3 for dynamic coefficient of friction

3.6 CLOSEOUT ACTIVITIES AND PROTECTION

A. Maintenance training – CPAA Craftsman shall train Owner's personnel in proper procedures for maintaining polished concrete floor.

B. Covering – after completion of polishing, protect polished floors from subsequent construction activities with protective covering.

END OF SECTION

SECTION 09 65 19.1

RESILIENT TILE FLOORING

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide Resilient Tile Flooring as indicated or scheduled on the Drawings.
   02 Provide Resilient Cove Base as indicated or scheduled on the Drawings.
   03 Provide transition trim between different flooring types.

C. Related Work:
   01 Section 03 30 00 – Cast-In-Place Concrete.
   02 Division 9 – All other flooring specifications.

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

D. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01 Include recommended cleaning products and instructions for use.
   02 Where applicable, provide recommended maintenance schedules and procedures.

E. Color / Finish Samples:
   01 Provide two (2) samples of each finish for selection by the Architect.
   02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.

03 Minimum size shall be 8” x 8” but must be large enough to convey attributes of the proposed product.

1.3 REFERENCES

A. ASTM International:
- 01 ASTM D2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces.
- 02 ASTM E 648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.
- 03 ASTM E 662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
- 04 ASTM F 141 – Standard Terminology Relating to Resilient Floor Coverings
- 05 ASTM F 710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
- 06 ASTM F 925-13 - Standard Test Method for Resistance to Chemicals of Resilient Flooring.
- 07 ASTM F970 - Standard Test Method for Measuring Recovery Properties of Floor Coverings after Static Loading.
- 08 ASTM F1515 - Standard Test Method for Measuring Light Stability of Resilient Flooring by Color Change.
- 09 ASTM F 1861 - Standard Specification for Resilient Wall Base.
- 10 ASTM F 1869 - Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- 11 ASTM F1914 - Standard Test Methods for Short-Term Indentation and Residual Indentation of Resilient Floor Covering.
- 12 ASTM F 2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in Situ Probes.
- 13 ASTM F 2195 – Standard Specifications for Linoleum Tile Floor Covering

B. National Fire Protection Association (NFPA):
- 01 NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
- 02 NFPA 258 - Standard Test Method for Measuring the Smoke Generated by Solid Materials.

1.4 QUALITY ASSURANCE

A. Deliver materials in good condition to the jobsite in the manufacturer's original unopened containers that bear the name and brand of the manufacturer, project identification, and shipping and handling instructions.

B. Store materials in a clean, dry, enclosed space off the ground, and protected from the weather and from extremes of heat and cold. Protect adhesives from freezing.
- 01 Store flooring, adhesives and accessories in the spaces where they will be installed for at least 48 hours before beginning installation.

C. Installer Qualifications: Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
- 01 Engage installers certified by Manufacturer
- 02 Proof of valid certification must be submitted to the General Contractor and verified by Manufacturer.

03 Certified Technicians must be present on the jobsite daily while product is being installed.

D. Standard of Quality Mock-Up: For the purpose of evaluating the quality of workmanship, install a mock-up of the specified flooring completed by the pre-qualified installers following the manufacturer's installation recommendations.
01 Obtains Owner's and Architect's acceptance of finish color, texture and pattern, and workmanship standard.
02 Upon approval of mock-up, this installation shall be considered the standard of quality and basis of comparison for the balance of the project.
03 Areas found to be deficient by specification standards or application procedures shall be repaired or replaced at the Contractor's expense.
04 Incorporation of mock-up: The mock-up may be incorporated into final construction upon Owner's approval.

1.5 PROJECT CONDITIONS

A. Maintain a minimum temperature in the spaces to receive the flooring and accessories of 65ºF and a maximum temperature of 85ºF for at least 48 hours before, during, and for not less than 48 hours after installation.

B. Thereafter, maintain a minimum temperature of 55ºF in areas where work is completed.

C. Protect all materials from the direct flow of heat from hot-air registers, radiators, or other heating fixtures and appliances.

D. Slab Moisture Content:
01 Provide RH testing of floor slab in accordance with manufacturer's standards and directions. Testing shall be provided by Flooring Subcontractor. Test results must be submitted by the Contractor and reviewed by the Contractor, Architect and Owner's Rep prior to installation of tile.
02 Flooring specifications are based on RH levels at 100% or less.

1.6 WARRANTY

A. Resilient Flooring System: Submit a written warranty executed by the manufacturer, agreeing to repair or replace system (subfloor preparation products, adhesive, and floor covering) that fails within the warranty period.

B. Warranty Period: Minimum 20 years from date of substantial completion.

PART 2 - PRODUCTS

2.1 RESILIENT LINEOLEUM TILE FLOORING MANUFACTURERS

A. Design of resilient linoleum flooring tile is based on specific products, finishes and colors as manufactured by Forbo as identified on the drawings.

B. Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this section, provide all proposed products meet or exceed the specified requirements. Additionally, the products proposed for use are equal

to the basis of design products, including color and size if specific products as identified on the Drawings and / or finish schedules. Submit proposed product for review and acceptance by Architect during bidding / proposal phase. Substitutions proposed after bidding / proposal phase will not be accepted.

01 Armstrong Flooring
02 Tarkett

2.2 RESILIENT LINOLEUM FLOORING TILE MATERIALS

A. Product is based on Forbo's Marmoleum MCT, or approved equal, as indicated on drawings.

B. Product to be heterogeneous linoleum tile made primarily of natural materials consisting of linseed oil, wood flour, and rosin binders, mixed and calendared onto a polyester backing to ensure optimum dimensional stability.

C. Pattern and color shall extend throughout total thickness of material.

D. Size: 13"x13" nominal

E. Color: As indicated on drawings

F. Patterns: As indicated on drawings.

G. Finish: Topshield2 applied during the manufacturing process

H. Primers and Adhesives:
   01 Concrete Slab Primer: Non-staining type as recommended by Manufacturer.
   02 Adhesives: Forbo TD EZ-ON 100 adhesive, rated for 100% RH.

2.3 RESILIENT RUBBER MANUFACTURERS

A. Design of resilient rubber materials is based on specific products, finishes and colors as manufactured by Roppe as identified on the Drawings.

B. Design of metal transitions is based on specific products, finishes and colors as manufactured by Schluter Systems as identified on the Drawings.

C. The following manufacturers are acceptable provided the products proposed for use are equal to the basis of design products, including color if specific products as identified on the Drawings and / or finish schedules.
   01 R.C. Munson.
   02 Flexco.
   03 Nora Rubber Co.
   04 Burke-Mercer.
   05 Johnsonite.

2.4 RESILIENT MATERIALS

A. Base:
   01 Design is based on Roppe Pinnacle Rubber Cove base.
   02 Quality Standard. ASTM-1861-98, Type TS 100% rubber base.
   03 Type. Top-set cove; standard toe.

04 Length: Rolled.
05 Height. 4” inches, unless shown otherwise.
06 Thickness. Full 0.125.
07 Color. As indicated on drawings.

B. Resilient Stringer Skirt: Cut to match riser and tread profile, and to meet wall base height of same material, color and thickness as base.

C. Primers and Adhesives:
01 Concrete Slab Primer: Non-staining type as recommended by material manufacturers.
02 Adhesives: Waterproof, stabilized type as manufactured by resilient material manufacturer.

2.5 METAL TRANSITION MATERIALS

A. Design is based on products manufactured by Schluter Systems.

B. Flooring Transitions: Provide the following flooring transitions where applicable:
01 Resilient Tile Flooring to similar height floor finish: VINPRO-S
02 Resilient Tile Flooring to same height resilient tile flooring: VINPRO-T
03 Resilient Tile Flooring to floor coverings at lower elevations: VINPRO-U

C. Stair Nosing: Provide the following stair nosing where indicated on the Drawings:
01 Monumental / Open Stairways: Model TREP-E.
02 Stainless steel with slip resistant wear surface.
03 Size: 1-3/16” horizontal surface by 3/8” front edge.
04 Verify exact height required for specific finish floor material installed on stair treads.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

B. Subfloors:
01 Verify that substrate is smooth, level, at required finish elevation, and without more than 1/8 inch in 10'-0" variation from level or slopes shown on the drawings.
02 Prior to laying materials, clean the surfaces to be covered in strict accordance with flooring manufacturer’s recommendations.

3.2 INSTALLATION

A. Install flooring and accessories after the other finishing operations, including painting, have been completed.
01 Close spaces to traffic during and after installation of the flooring for length of time recommended by flooring manufacturer.
02 Do not install flooring over concrete slabs until they are sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond and moisture tests.

03 Protect floor as required by manufacturer until construction work is complete.

B. Installing Resilient Tiles:
01 Place units with adhesive cement in strict compliance with the manufacturer's recommendations.
02 Butt units tightly to vertical surfaces, nosings, edgings, and thresholds.
03 Scribe, as necessary, around obstructions and to produce neat joints.
04 Place tiles tightly laid, even, and in straight parallel lines.
05 Extend units into toe spaces, door reveals, and in closets and similar spaces.
06 Lay units from center marks established with principal walls, discounting minor offsets, so that units at opposite edges of the room are of equal width.
a. Adjust as necessary to avoid use of cut widths less than 3 inches wide at edge of space.
b. Lay units square to axis of the room or space.
07 Match units for color and pattern by using materials from cartons in the same sequence as manufactured and packaged.
08 Lay in alternating pattern with grain in all units running 90 degrees from adjacent unit.
09 Place resilient edge strips tightly butted to units and secured with adhesive, providing at all unprotected edges, unless otherwise shown.

C. Installing Base:
01 Install base on solid backing. Adhere tightly to wall and floor surfaces.
02 Scribe and fit to doorframes and other obstructions.
03 Install base on all casework as shown, unless otherwise noted.
04 Provide “Liquid Nails” adhesive at all transitions.

3.3 CLEANING AND PROTECTING

A. Remove excess adhesive and other blemishes from exposed surfaces, using neutral cleaner recommended by the manufacturer of the resilient materials.

3.4 EXTRA STOCK

A. Deliver to the Owner for his future use an extra stock of 2 percent, rounded up, of each color and pattern of tile selected, and one container of base adhesive. Clearly label each box with the school name. Provide full boxes only. Partial boxes will not be accepted.

END OF SECTION

SECTION 09 65 19.2

RESILIENT TILE FLOORING
(LUXURY VINYL TILE (LVT))

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide Luxury Vinyl Tile as indicated or scheduled on the Drawings.
   02 Provide “Floating” Luxury Vinyl Tile floor at Pressbox.
   03 Provide Resilient Cove Base as indicated or scheduled on the Drawings.
   04 Provide transition trim between different flooring types.

C. Related Work:
   01 Section 03 30 00 – Cast-In-Place Concrete.
   02 Division 9 – All other flooring specifications.

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer’s literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Installation Instructions: Submit manufacturer’s complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

D. Maintenance Instructions: Submit manufacturer’s complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01 Include recommended cleaning products and instructions for use.
   02 Where applicable, provide recommended maintenance schedules and procedures.

E. Color / Finish Samples:
   01 Provide two (2) samples of each finish for selection by the Architect.
   02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.

03 Minimum size shall be 8” x 8” but must be large enough to convey attributes of the proposed product.

1.3 REFERENCES

A. ASTM International:
- 01 ASTM D2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces.
- 02 ASTM E 648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.
- 03 ASTM E 662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
- 04 ASTM F 710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
- 05 ASTM F 925-13 - Standard Test Method for Resistance to Chemicals of Resilient Flooring.
- 06 ASTM F970 - Standard Test Method for Measuring Recovery Properties of Floor Coverings after Static Loading.
- 07 ASTM F1515 - Standard Test Method for Measuring Light Stability of Resilient Flooring by Color Change.
- 08 ASTM F 1700 - Standard Specification for Solid Vinyl Tile.
- 09 ASTM F 1861 - Standard Specification for Resilient Wall Base.
- 10 ASTM F 1869 - Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- 11 ASTM F1914 - Standard Test Methods for Short-Term Indentation and Residual Indentation of Resilient Floor Covering.
- 12 ASTM F 2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in Situ Probes.

B. National Fire Protection Association (NFPA):
- 01 NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
- 02 NFPA 258 - Standard Test Method for Measuring the Smoke Generated by Solid Materials.

1.4 QUALITY ASSURANCE

A. Deliver materials in good condition to the jobsite in the manufacturer's original unopened containers that bear the name and brand of the manufacturer, project identification, and shipping and handling instructions.

B. Store materials in a clean, dry, enclosed space off the ground, and protected from the weather and from extremes of heat and cold. Protect adhesives from freezing.
- 01 Store flooring, adhesives and accessories in the spaces where they will be installed for at least 48 hours before beginning installation.

1.5 PROJECT CONDITIONS

A. Maintain a minimum temperature in the spaces to receive the flooring and accessories of 65ºF and a maximum temperature of 85ºF for at least 48 hours before, during, and for not less than 48 hours after installation.

B. Thereafter, maintain a minimum temperature of 55ºF in areas where work is completed.

C. Protect all materials from the direct flow of heat from hot-air registers, radiators, or other heating fixtures and appliances.

D. Slab Moisture Content:
   01 Provide RH testing of floor slab in accordance with manufacturer's standards and directions.
   02 Flooring specifications are based on minimum RH levels of 99%.

E. Contractor to conduct slab moisture tests as needed to ensure moisture levels do not exceed maximum allowable moisture content as allowed by the flooring manufacturer.

1.6 WARRANTY

A. Resilient Flooring System: Submit a written warranty executed by the manufacturer, agreeing to repair or replace system (subfloor preparation products, adhesive, and floor covering) that fails within the warranty period.

B. Warranty Period: 20 years.

PART 2 - PRODUCTS

2.1 LUXURY VINYL TILE MANUFACTURERS

A. Design of luxury vinyl tile (LVT) resilient flooring based on products manufactured by Mohawk Group.

2.2 GENERAL

A. Physical Properties:
   01 Classification: ASTM F1700 Class III Type B.

B. Physical Performance

01	Flexibility:	ASTM F137	Pass
02	Static Load:	ASTM F970	Pass
03	Residual Indentation:	ASTM F1914	Pass
04	Flammability:	ASTM E648	NFPA Class 1
05	Slip Resistance:	ASTM D2047	Pass / ADA Compliant
06	Smoke Density:	ASTM E662	<450
07	Chemical Resistance:	ASTM F925	Pass
08	Resistance to Light:	ASTM F1515	Pass

2.3 LUXURY VINYL TILE

A. Product is based on Molveno Woods (C0110) as manufactured by Mohawk Group.

B. LVT Planks:
   01 8" x 60" x 6 mm with 20 mil wear layer.
   02 Finish: M-Force
   03 Refer to drawings for locations.
   04 Color: As noted on drawings.
   05 Edge Treatment: Micro-beveled.

C. LVT Patterns:
   01 Provide LVT tile patterns as indicated on the Drawings.
   02 All patterns shall be composed of full tile sizes, except edge conditions, unless indicated otherwise on the Drawings.

D. LVT Adhesive: None required.

E. To be used at Press box only.

2.4 RESILIENT RUBBER MANUFACTURERS

A. Design of resilient materials is based on specific products, finishes and colors as manufactured by Roppe as identified on the Drawings.

B. Design of metal transitions is based on specific products, finishes and colors as manufactured by Schluter Systems as identified on the Drawings.

C. The following manufacturers are acceptable provided the products proposed for use are equal to the basis of design products, including color if specific products as identified on the Drawings and / or finish schedules.
   01 R.C. Munson.
   02 Flexco.
   03 Nora Rubber Co.
   04 Burke-Mercer.
   05 Johnsonite.

2.5 RESILIENT MATERIALS

A. Base:
   01 Design is based on Roppe Rubber Cove base.
   02 Quality Standard. ASTM-1861-98, Type TS 100% rubber base.
   03 Type. Top-set cove; standard toe.
   04 Length: Rolled.
   05 Height. 4” inches, unless shown otherwise.
   06 Thickness. Full 0.125.
   07 Color. As noted on drawings.

B. Primers and Adhesives:
   01 Concrete Slab Primer: Non-staining type as recommended by material manufacturers.
   02 Adhesives: Waterproof, stabilized type as manufactured by resilient material manufacturer.

2.6 METAL TRANSITION MATERIALS

A. Design is based on products manufactured by Schluter Systems.

B. Flooring Transitions: Provide the following flooring transitions where applicable:
   01 Porcelain Tile to LVT: Model Reno EU or Schiene.
   02 Porcelain Tile to carpet: Model Schiene
   03 Porcelain Tile to sealed concrete: Model Reno-U
   04 Carpet to LVT: Model Reno EU. Use black transition edge strip
   05 Carpet to Concrete or LVT to Concrete: Model Jolly or Schiene.

06 Resilient Tile Flooring to similar height floor finish: VINPRO-S
07 Resilient Tile Flooring to same height resilient tile flooring: VINPRO-T
08 Resilient Tile Flooring to floor coverings at a lower elevation: VINPRO-U
09 Provide transitions in sizes appropriate to the interfacing finish flooring materials.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.
01 For concrete substrates with high residual moisture, notify Owner, Owner's rep and hydraulic cement underlayment manufacturer for recommended preparation to achieve system installation warranty. Reference 03 54 16 – Hydraulic Cement Underlayment.

B. Subfloors:
01 Verify that substrate is smooth, level, at required finish elevation, and without more than 1/8 inch in 10'-0" variation from level or slopes shown on the drawings.
02 Prior to laying materials, broom clean or vacuum the surfaces to be covered, and inspect the subfloors.

3.2 INSTALLATION

A. Install flooring and accessories after the other finishing operations, including painting, have been completed.
01 Close spaces to traffic during the installation of the flooring.

B. Installing Resilient Tiles:
01 Butt units tightly to vertical surfaces, nosings, edgings, and thresholds.
02 Scribe, as necessary, around obstructions and to produce neat joints.
03 Place tiles tightly laid, even, and in straight parallel lines.
04 Extend units into toe spaces, door reveals, and in closets and similar spaces.
05 Lay units from center marks established with principal walls, discounting minor offsets, so that units at opposite edges of the room are of equal width.
a. Adjust as necessary to avoid use of cut widths less than 3 inches wide at edge of space.
b. Lay units square to axis of the room or space.
06 Match units for color and pattern by using materials from cartons in the same sequence as manufactured and packaged.
07 Place resilient edge strips tightly butted to units and secured with adhesive, providing at all unprotected edges, unless otherwise shown.

C. Installing Base:
01 Install base on solid backing. Adhere tightly to wall and floor surfaces.
02 Scribe and fit to doorframes and other obstructions.
03 Install base on all casework as shown, unless otherwise noted.
04 Provide "Liquid Nails" adhesive at all transitions.

05 Do not install resilient base on top of vinyl wall covering. Stop vinyl wall covering 3 inches from finish floor for 1 inch overlap with base.

3.3 CLEANING AND PROTECTING

A. Remove excess adhesive and other blemishes from exposed surfaces, using neutral cleaner recommended by the manufacturer of the resilient materials.

3.4 EXTRA STOCK

A. Deliver to the Owner for their future use an extra stock of 2% of each color of tile installed.

END OF SECTION

SECTION 09 66 13.13

SAND CUSHION TERRAZZO FLOORING

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide all sand cushion terrazzo flooring as indicated or scheduled on the Drawings.
   02 Repair existing sand cushion terrazzo flooring as required to complete renovation work.
   03 Provide in color(s) and patterns as indicated.

C. Related Work:
   01 Section 03 30 00 – Cast-In-Place Concrete
   02 Section 04 20 00 – Unit Masonry

1.2 SUBMITTALS

A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Manufacturer / Installer Qualifications:
   01 Submit proof of associate membership in National Terrazzo & Mosaic Association (NTMA).
   02 Submit manufacturer's evidence of a minimum ten (10) years of experience.
   03 Submit proof of contractor / installer membership in NTMA.

D. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.

E. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

F. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01 Include recommended cleaning products and instructions for use.
   02 Where applicable, provide recommended maintenance schedules and procedures.

G. Color / Finish Samples:
   01 Provide two (2) samples of each finish for selection by the Architect.
   02 Finish samples shall be provided of / on actual materials and mix ratios proposed to be used.
   03 Minimum size shall be 12" x 12", but must be large enough to convey attributes of the proposed product.
   04 Provide samples of divider strips and control / expansion joints; minimum 6" length(s).

1.3 REFERENCES

A. ASTM International:
   01 ASTM C97/C97M - Absorption and Bulk Specific Gravity of Dimension Stone
   02 ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens.
   03 ASTM C150/C150M - Standard Specification for Portland Cement
   04 ASTM C241/C241M - Standard Specification for Abrasion Resistance of Stone Subjected to Foot Traffic
   05 ASTM C501 Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abrader
   06 ASTM D2047 - Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine.
   07 ASTM E84 - Standard Test Method for Surface Burning characteristics of Building Materials
   08 ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
   09 ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission

B. Conform to all applicable requirements of "Terrazzo Specifications and Technical Data", as published by the National Terrazzo and Mosaic Association, Inc (NTMA). - latest edition.

C. Acceptable Installer: Installer shall be a contractor member NTMA.

PART 2 - PRODUCTS

2.1 MANUFACRTURERS

A. Design of terrazzo flooring is based on products provided by Southern Tile and Terrazzo Co., Inc.

B. Acceptable Manufacturers: The following manufacturers are acceptable provided all proposed products meet or exceed all specified requirements.
   01 Continental Terrazzo Supply

02 Master Terrazzo
03 National Terrazzo Tile & Marble
04 Terrazzo & Marble Supply Companies

2.2 MATERIALS

A. Portland Cement: ASTM C150 Type 1, white.
01 Colorants added as required to create and match samples or colors selected by the Architect from submitted samples.
02 Where scope requires patching or matching existing terrazzo, installer shall verify field conditions and proceed accordingly.

B. Sand: Clean, hard, natural or manufactured conforming with ASTM C33 for fine aggregate.

C. Mortar Bed Fill: One part Portland Cement and four parts clean, coarse, screened sand. Color-tinted gray or white, as required.

D. Marble Chips: Granulated chips of marble, granite and quartz, of such sizes to produce intermediate terrazzo. (#1, #2, #3, and #4 size chips) per NTMA standards and recommendations.
01 Chip size(s), type(s) and colors(s) as required to create and match samples selected by the Architect from submitted samples.

E. Water: Potable

F. Reinforcing: Galvanized welded wire mesh, 2” x 2”, 16 gauge in accordance with ASTM A185

G. Joint Strips: White alloy of zinc (See Drawings for locations.)
01 Division Strips: 1/4 inch heavy top strip, verify depth
02 Control Joint/Expansion Joint: Standard type neoprene filler expansion strip; verify white or black and depth. Locate over slab joints.
03 Edging Strip: Use at locations where terrazzo abuts carpet, VCT, CT, and other flooring types. Verify depths.
04 Refer to Drawings for locations and patterns. If none are shown, calculate at maximum 60” O.C. both ways and confirm with Architect.

H. Curing Material: Liquid membrane, non-staining paper, polyethylene or clean water (ASTM C309).

I. Neutral Cleaner: A neutral liquid cleaner prepared for the terrazzo trade.

J. Sealer: Penetrating type, free from harmful alkali or acid content.
01 Sealer specially prepared for terrazzo trade.
02 UL listed as Slip Resistant

K. Isolation Membrane: 0.004” (4 mil) polyethylene sheeting ASTM D2103 - Type 13300

2.3 MIXES

A. General Proportions:
01 Underbed: One part Portland cement to four parts sand and sufficient water to provide workability at as low a slump as possible.

02 Terrazzo Topping: One 94 pound bag of Portland cement per 200 – 220 pounds of marble chips, color pigment if required and sufficient potable water to produce a workable mix.

B. Terrazzo Type:
01 Match existing color

C. Mixing:
01 Underbed:
a. Charge and mix sand and Portland cement.
b. Add water and mix.
02 Terrazzo Topping:
a. Charge and mix marble chips, Portland cement and color pigment if required.
b. Add water and mix to a uniform workable consistency.
03 Chips and cement to be identical to those used in approved sample.

PART 3 - EXECUTION

3.1 INSPECTION

A. Thoroughly examine areas to receive terrazzo for:
01 Deviations beyond allowable tolerances for the concrete slab work.
02 Defects in existing work that affect proper execution of terrazzo work as indicated on the Drawings.

B. Report any / all deficiencies to the Contractor and do not proceed until all remedial work is complete.

3.2 INSTALLATION

A. Underbed:
01 Cover entire surface to receive terrazzo with dusting of sand, +/- 1/16”.
02 Install isolation membrane overlapping ends and edges a minimum of 3 inches.
03 Install welded wire reinforcement. Overlap wire at edges and ends at least 2 squares.
04 Place underbed mix.
05 Screed underbed to elevation 1⁄2 inch below finished floor elevation or slope.
06 Install divider strips as shown on Drawings in semi-plastic underbed and trowel firmly along edges.

B. Placing Terrazzo:
01 Saturate underbed with water.
02 Place terrazzo mixture in panels formed by divider strips and trowel mixture to top of strips.
03 Seeding of additional marble chips is optional.
04 Roll and compact surface until all excess cement and water has been extracted.
05 Trowel to a dense uniform flat surface disclosing lines of divider strips.

C. Curing:
01 After completing placement of terrazzo and composition has sufficiently set, cover with water, wet sand or polyethylene sheeting.

02 Cure until topping develops sufficient strength to prevent lifting or pulling of terrazzo chips during grinding.

D. Finishing:
01 Rough Grinding: Grind with 24 or finer grit stones or with comparable diamond plates. Follow initial grind with 80 or finer grit stones.
02 Grouting: Cleanse floor with clean water and rinse. Remove excess rinse water and machine or hand-apply grout, taking care to fill all voids.
03 Cure Grout: Cure in accordance with ASTM C-309. With due regard for weather conditions during the curing process, installer shall determine time suitable for curing.
04 Contractor's option to leave grout on terrazzo until all heavy and potentially harmful work of the project is completed.
05 Fine Grinding: Grind with 80 or finer grit stones until all grout is removed from surface. Upon completion, terrazzo shall show a minimum of 70% marble chips and shall match samples selected by the Architect.

E. Cleaning and Sealing:
01 Wash all surfaces with a neutral cleaner.
02 Rinse with clean water and allow surface to dry.
03 Apply sealer in accordance with manufacturer's directions.

3.3 PROTECTION

A. Immediately after application and curing of sealer, clean all surfaces of dirt, abrasive particles and other foreign material which may be harmful.

B. Provide a protective, non-staining building paper or other suitable material, as required to protect terrazzo flooring from damage by other trades.

C. Near completion of the project, remove protective surfacing.
01 Terrazzo Contractor shall inspect entire floor and address any imperfections or defects resulting while covered.
02 Clean and treat all surfaces with polishing material recommended by manufacturer.

END OF SECTION

SECTION 09 67 23

RESINOUS FLOORING

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Remove existing epoxy flooring at locations indicated on drawings.
   02 Furnish and install new slip-resistant urethane flooring as specified and indicated in this section.

C. Related Work:
   01 Section 03 30 00 – Cast-In-Place Concrete
   02 Section 03 54 17 – Self-leveling Floor Underlayment
   03 Section 04 20 00 – Unit Masonry
   04 Section 09 30 13 – Ceramic Tiling

1.3 SUBMITTALS

A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01 Include recommended cleaning products and instructions for use.
   02 Where applicable, provide recommended maintenance schedules and procedures.

F. Color / Finish Samples:
   01 Provide two (2) samples of each finish for selection by the Architect.

02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
03 Minimum size shall be 3” x 3”, but must be large enough to convey attributes of the proposed product.

G. Manufacturer’s Certification: Submit manufacturer’s certification that materials comply with specified requirements and are suitable for intended application.

H. Applicator’s Project References: Submit applicator’s list of successfully completed resinous flooring system projects, including project name and location, name of architect, and type and quantity of flooring systems applied.

I. Warranty: Submit a copy of the Manufacturer’s / Installer’s warranty.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with a minimum five years documented experience.

B. Applicator’s Qualifications:
01 Applicator regularly engaged, for a minimum of 5 years, in application of resinous flooring systems of similar type to that specified.
02 Employ persons trained for application of resinous flooring systems.

C. Source Limitations: Provide each type of product from a single manufacturing source to ensure uniformity.

D. Mock-Up: Construct a mock-up with actual materials in sufficient time for Architect’s review and to not delay construction progress. Locate mock-up as acceptable to Architect and provide temporary foundations and support.
01 Intent of mock-up is to demonstrate quality of workmanship and visual appearance.
02 If mock-up is not acceptable, rebuild mock-up until satisfactory results are achieved.
03 Retain mock-up during construction as a standard for comparison with completed work.
04 Do not alter or remove the mock-up until work is completed or removal is authorized.
05 Adjust texture as requested by Architect and/or Owner in field.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Material shall be delivered to project site in manufacturer’s original unopened containers.

B. Materials shall be stored indoors, protected from damage, moisture, direct sunlight and temperatures below 40°F or above 90°F.

C. Do not use drain piping for disposal of coating materials.

D. The Contractor shall take all precautions and implement all measures necessary to avert potential hazards associated with the seamless urethane flooring system materials.

E. Deliver all materials to the job site in new, unopened containers. Each container shall bear the manufacturer’s name and label.

1.6 ENVIRONMENTAL CONDITIONS

A. Do not apply flooring system under ambient conditions outside manufacturer's limits.

B. Verify surfaces and moisture content within concrete slabs, both existing and new, are suitable and within manufacturer's specifications for the proper installation of the flooring system.
   01 In areas of unsuitable concrete slab conditions, Contractor shall, subject to the approval of the Architect, deliver the proposed remedial steps to be taken to bring the concrete slab to meet minimum requirements.
   02 Do not proceed until all slab conditions are suitable for the proper installation of the flooring system.

C. Do not apply coating materials when dust is being generated.

1.4 WARRANTY

A. Manufacturer to warranty the materials specified here within are to be free from manufacturing defects for a period of one (1) year from the date of substantial completion.
   01. Cracking / splitting
   02. Delamination
   03. Adhesion failure

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Crossfield Products Corporation:
   01 Basis of Design: Dex-O-Tex Tek-Crete SL-CQ
   02 Thickness: 1/8" – 1/4"

B. Key Resin Company

C. Surface Solutions, Inc.

2.2 MATERIALS

A. Blended, two-component urethane resin and curing agent, mixed with a pre-engineered special aggregate and finished with a decorative colored quartz broadcast of aggregate into the resinous grout or into wet base polyurethane mortar followed by a lock-coat topcoat.

B. Color: Color and blend as selected by Architect from Manufacturer's standard color line

C. Primer and Sealer: As recommended by manufacturer. Color to match existing.

D. Metal Control Joint: Zinc alloy, 14-gauge as recommended by manufacturer.

E. Finish texture: #60 silica broadcast. If needed, adjust texture in field as instructed by Architect and or Owner per approved mockup.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas to receive seamless flooring, to ensure that slab does not deviate from allowable level tolerances, and that there are no structural cracks. Report unsatisfactory surfaces to Architect prior to installation commencement. Beginning of work constitutes acceptance of subfloor.

3.2 PREPARATION

A. At all locations to receive new urethane flooring, remove existing flooring in its entirety by shotblasting or grinding existing flooring and prep existing concrete slab for new urethane floor installation as recommended by manufacturer.
   a. At bleacher location, remove existing coating as recommended by flooring manufacturer. Prep substrate to receive new urethane coating.
   b. Seal cracks in slab or provide crack isolation membrane as recommended by manufacturer.
   c. Protect cast stone at pool edge and any element scheduled to remain as required for flooring installation.
   d. Remove existing sealant between existing floor and cast stone at pool edge and prep area to receive new sealant.

3.3 INSTALLATION

A. Secure stop and divider strips to subfloor at construction joints and other locations as directed.

B. Provide divider strip and sealant between urethane flooring and tile depth markers. Coordinate with Section 09 30 13 – Ceramic Tiling.

C. Provide new sealant between urethane flooring and cast stone at pool edge.

D. Prime subfloor, place mixture and trowel to level. Apply sealer in accordance with manufacturer's printed instructions.

E. After completing placement of flooring, cure in accordance with manufacturer's recommendations.

3.4 CLEANING

A. Immediately prior to Owner's occupancy or final inspection, thoroughly scrub floor with neutral cleaner solution unless directed otherwise by manufacturer. Rinse surface thoroughly with clean water.

END OF SECTION

SECTION 09 68 19

CARPET (FACTORY APPLIED ADHESIVE)

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB - Instructions to Proposers and Section AF – Subcontractor and Manufacturer Prequalification for substitutions.

B. Scope of Work:
   01 Furnish and install all carpet as indicated.
   02 Resilient base information is included in Div 9 – resilient flooring.

C. Related Work:
   01 Section 01 71 50 – Preventative Housekeeping and Final Carpet Cleaning
   02 Section 09 65 19.1 – Resilient Tile Flooring (Linoleum)
   03 Section 09 65 19.2 – Resilient Tile Flooring (LVT)

1.2 SUBMITTALS

A. Provide all submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Shop drawings to the Architect showing layout of all seams and cross seams, location, and type of carpet accessories. Indicate method of joining seams, direction of carpet pattern and pile, borders, and location of edge moldings and edge bindings.

C. Certificate showing manufacturer's loom on which carpet will be produced, and date of last inspection for specification tolerances.

D. Samples showing manufacturer's matching color (12" x 12"). Actual base and accessory samples.

E. Actual sample from loom to produce run of carpet.

F. Manufacturer’s product data. Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available and method of installation.

G. Maintenance instructions. Include maintenance/cleaning procedures, recommended cleaning materials and suggested schedule for cleaning.

1.3 WARRANTY

A. Manufacturer shall warrant the carpeting against the following defects:
   01 Dimensional stability including curling.
   02 Edge ravel.
   03 Delamination of backing.
   04 Wear in excess of 10% by weight.

B. Provide manufacturer's lifetime written warranty for materials and labor starting at date of substantial completion.

C. Manufacturer shall warrant that the generation of static electricity shall not exceed 3.5 KV at 70°F at 20% RH for the life of the carpet.

D. Contractor to provide written one (1) year warranty for labor and materials from substantial completion date.

1.4 QUALITY CONTROL

A. Installer qualifications: Company specializing in installing carpet with minimum five (5) years documented experience and must be certified by specified manufacturer. Use for installation only personnel who are skilled in the work required, familiar with the manufacturer's recommended methods required for installation.

B. Examination: Contractor to be responsible for moisture test to ensure pH range recommended by carpet manufacturer is achieved. Owner to receive copy of test results, indicating compliance with manufacturer's recommendation.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Manufacturer to off gas carpet at their facilities prior to shipping to jobsite.

B. Store materials in area of installation for three (3) days prior to installation to achieve temperature stability.

C. Maintain temperature for installation as per Manufacturers recommendation.

D. Ventilate installation area during installation and for three (3) days after installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Tarkett

2.2 MATERIALS

A. Provide carpet free of any irregularities in weave or materials, and each color of one dye lot. Carpet shall be moth and vermin-proof, and pre-shrunk carpet.

B. Carpeting:

01 Field Carpet: Aftermath II by Tarkett; color and pattern as indicated on interior finish legend.

a. Construction: Stratatec Patterned Loop
b. Width: 6 feet roll goods.
c. Gage: 5/64 inch.
d. Tufts Per Inch: 8.50
e. Average Pile Height: .185 inch
f. Pile Yarn Weight: 81 oz per square yard.

g. Pile Yarn Content: Dynex SD Nylon / Dynex Nylon
h. Fiber System: Solution Dyed/Yard Dyed.
i. Dye Method: 90% Solution Dyed / 10% Yarn Dyed.
j. Primary Backing: Synthetic Non-Woven
k. Secondary Backing: Powerbond RS Closed Cell Vinyl Cushion Backing System
l. Flammability: Class 1 (ASTM E648)
m. Smoke Density: 450 or less (ASTM E662)
n. Electrostatic Propensity: 1.5 kV (AATCC 134); Permanent Conductive Fiber

02 Entrance "Walk-off" Carpet (walk-off mat):
a. Field Carpet: Assertive Action by Tarkett. Color as indicated on drawings.
b. Install at all entries that lead directly to the exterior at new building additions. Minimum six (6) feet into building from entrance or as shown on drawings.
c. Width: 6 foot roll
d. Primary Backing: Non-woven synthetic fiber
e. Construction: Symtex
f. Face Weight: 29 oz/sq yd
g. Gauge: 1/10
h. Stitches per Inch: 9.0
i. Pile Height Average: 0.187 inch
j. Dye Method: 100% Solution Dyed
k. Colorfastness to Light: > 4 after 100 hours (AATCC 16E)
l. Surface Flammability: Passes CPSC FF 1-70 (ASTM D-2859)
m. Smoke Generation: Less than 450 (ASTM E-662)
n. Peel and Stick: RS Adhesive System – Full Coverage Peel & Stick

C. Carpet Accessories and Adhesive:
01 Standard accessories as recommended by the successful carpet manufacturer.
02 Carpet edge shall be vinyl overlap type for glue-down carpet.
03 Adhesive as recommended by carpet manufacturer.
04 Metal Transition Strips: Provide metal transition strips, threshold, gripper edges and other accessories of standard quality for all transitions of carpet floor finish to other floor finishes, including nosings at carpeted steps or stairs. Provide metal strips as manufactured by Schluter. Products shall be VINPRO-S, VINPRO-T or VINPRO-U as applicable. Mechanically fasten to slab.

PART 3 - EXECUTION

3.1 PREPARATION

A. Deliver carpet to the job site in original mill scrapings, if full rolls. Store carpet raised above floor, under cover, and in well ventilated spaces, as soon as delivered. Protect carpet from damage, dirt, stains, and moisture.

B. The floor shall be clean and free of any foreign substances, such as wax, paint, oil, etc.

C. Cracks and holes shall be filled with latex emulsion filler compatible with adhesive. Apply, trowel and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

D. Any ridges and high spots in concrete surface shall be brought to the attention of the Architect and the General Contractor.

E. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.

F. Vacuum clean substrate

3.2 INSTALLATION

A. General:
- 01 Verify carpet match before cutting to ensure minimal variation between dye lots.
- 02 Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces.
- 03 Locate change of color or pattern between rooms under door centerline.
- 04 Provide monolithic color, pattern, and texture match within each contiguous area.
- 05 Install carpet tight and flat on subfloor, well fastened at edges, with uniform appearance.
- 06 Glue directly to floor using no pad and no foam. Roll carpet with a roller to ensure maximum contact at the pressure recommended by the manufacturer.
- 07 Scribe carpet accurately to all vertical surfaces.
- 08 Align lines of carpet as woven, using no fill strips less than 15 cm (6") in width, laying all carpet in same direction unless specifically otherwise directed by the Architect.
- 09 Manufacturer's technical representative to visit project site once carpet installation has begun and shall provide written certification letter indicating that the carpet installation is in accordance with manufacturer's recommendations. Manufacturer's representative shall provide training session with Owner's Maintenance personnel regarding care and cleaning procedures for completed carpet installation.

B. Stair Installation
- 01 Use direct glue down method in accordance with CRI 104 Section 12
- 02 Use one piece of carpet for each tread and riser below. Apply seam adhesive to cut edges.
- 03 Install carpet with pile direction in length of stair.
- 04 Adhere carpet tight to stair treads and risers.

C. Seams:
- 01 Locate seams in accordance with CRI 104 Section 7.2 and ~~only~~ where shown on approved shop drawings or where otherwise approved by Architect.
- 02 Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic.
- 03 Do not locate seams perpendicular through door openings

04 Fabricate seams by the compression method, using a butt joint, and properly bead and seal. Do not stretch seams.
05 Brush out or roll out air bubbles toward seam.
06 Carefully apply a bead seam adhesive to the cut edge at proper height to lock in tufts and seal edge. Do not use floor adhesive to bead cut edge. Use regular seam adhesive.

D. Clean-Up:
01 Thoroughly clean and vacuum all carpet surfaces prior to final acceptance of the carpeted areas by Owner. Leave work in neat, uniform condition, vacuumed and ready for use.
02 Any spillage of adhesive on the face of the carpet, base and wall surfaces shall be removed immediately with a clean-up solvent recommended by the manufacturer.
03 Avoid traffic for at least twelve hours after installation.
04 Carpet contractor shall repair any and all damage done by his workmen.
05 Provide traffic areas with heavy, non-staining building paper to protect against damage and soiling. Do not use plastic sheeting. Provide such protection when directed by the Architect.
06 Properly dispose of all existing carpet that was removed as part of the installation unless otherwise directed by Owner.
07 Remove all construction debris, etc. from work sites on a daily basis.
08 Return work area and all adjacent areas used for performing the work back to its original condition prior to carpet installation.
09 Use only Tandus Centiva approved carpet-cleaning subs.

3.3 EXTRA CARPET

A. After completion of the carpet installation, the carpet subcontractor shall provide the following:
01 An additional 3% of total yards installed of carpet (6' wide) to the Owner for future carpet replacement that may be required. This extra stock is to be unused rolls of the same run as installed carpet which does not include scraps. Label rolls with school name and deliver to the District warehouse or other offsite storage as directed by the District.
02 Two (2) unopened boxes of the same color and size of rubber base as used on the project. Extra material to be provided in boxes of 4’ lengths only; no coiled base.

3.4 GUARANTEE

A. The carpet installer shall be required to re-lay any carpet that does not provide an attractive wrinkle-free appearance and shall correct any condition due to faulty installation which may appear for a period of one (1) year from date of substantial completion.

END OF SECTION

SECTION 09 84 36

SOUND-ABSORBING CEILING UNITS ACOUSTICAL WALL PANELS, FABRICS AND DIFFUSERS

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB - Instructions to Proposers and Section AF – Subcontractor and Manufacturer Prequalification for substitutions.

B. Scope of Work:
   01 Install sound-absorbing acoustical wall panels where indicated on Drawings.

C. Related Work:
   01 04 20 00 Unit Masonry
   02 09 21 16 Gypsum Board Assemblies
   03 09 51 13 Acoustical Tile Ceilings
   04 09 91 00 Painting & Repainting

1.2 SUBMITTALS

A. Provide all submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Product Data: Manufacturer's technical data and installation instructions.

C. Shop Drawings: Show panel joints, detail references, dimensions and methods of attachment.

D. Samples: Manufacturer's full range of actual samples for selections by the Architect.

E. Installation Instructions: Manufacturer’s installation instructions for this application.

1.3 REFERENCES

A. American Society for Testing Materials: ASTM C423-77 and ASTM E84-77a.

1.4 QUALITY ASSURANCE

A. Provide acoustical panels of each type required from one manufacturer, of uniform texture and color.

B. Installer: Provide evidence of appropriate experience in system installation, and that installation method proposed is acceptable to panel manufacturer.

1.5 DELIVERY, STORAGE AND HANDLING

A. Carefully protect work during shipment, storage and installation.

B. Deliver materials to job site and store elevated above floor in an enclosed space with proper ventilation and protection from damage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Fabric Wrapped panels, pre-assembled wood panels, and ceiling pyramidal diffusers
   01 Conwed / Owens Corning.
   02 Sonotrol.
   03 Decoustics.
   04 AVL Systems, Inc.
   05 Sound Solutions, Inc.
   06 Lamvin Inc.
   07 Ventwood by Howard Mfg. Co.
   08 Acousta Wood, Inc.
   09 Wall Technology, Inc.
   10 Acoustical Resources, Inc.
   11 Acoustical Surfaces, Inc.
   12 MBI Products.
   13 Sound Concepts.

B. Speaker Cloth (“Grille Cloth”):
   01 Guilford of Maine.
   02 Acoustone Corporation.
   03 AVL Systems, Inc.
   04 Milliken / Kirsch Fabric Corporation.

2.2 MATERIALS

A. Acoustical Panel Type 1 (all panels over 7 feet above finish floor):
   01 Fiberglass core: 7 lb PCF with chemically-hardened beveled edges.
   02 NRC-.75.
   03 Fire Rating: Class A ASTM E84; flame spread shall be less than 25.
   04 Attach with manufacturer’s clip system for permanent wall mounting. Provide alternate fastening where top clearance is 0”.
   05 Size shall be as indicated on drawings.

B. Acoustical Panel Type 2 (all panels under 7 feet above finish floor):
   01 Type: Absorber Panels.
   02 Semi-rigid glass fiber core faced with 1/8 inch thick compressed fiberglass.
   03 NRC-.75.
   04 Fire Rating: Class A ASTM E84; flame spread shall be less than 25.
   05 Attach with manufacturer’s clip system for permanent wall mounting. Provide alternate fastening where top clearance is 0”. Provide retaining clip on top of each panel to prevent the panels from be lifted off clip system.
   06 Size shall be as indicated on drawings.

C. Acoustical Panel Thicknesses:
   01 Two inches at Orchestra and associated ensemble and practice rooms.

02 Two inches at Black Box.
03 Four inches at other sound-sensitive areas.
04 One inch at non-sound sensitive areas.

D. Acoustical Panel Fabric Face:
01 100% Polyester.
02 Minimum 16 oz. per square yard.
03 Colors as selected by the Architect.

PART 3 - EXECUTION

3.1 PREPARATION

A. Store in a dry, elevated location in air conditioned environment.

B. Field verify all dimensions as required to assure accurate fit / installation of acoustical wall panels without modifying in the field.

3.2 INSTALLATION

A. Install panels only after all wet work has been completed, and temperature conditions (approximate conditions), when space will be occupied.

B. Install panel plumb, in proper alignment, and in strict accordance with manufacturer's instructions and approved shop drawings. Shim wall track as necessary to provide a level frame work, provide spot adhesive to secure panels from movement if clip installation methods are used.

C. Arrange wall panels symmetrically on each wall, unless otherwise indicated. Lay out so that no panel is less than one-half the width of the typical panel, unless otherwise indicated n drawings.

D. Remove and replace panels which are damaged and unacceptable to Architect.

END OF SECTION

SECTION 09 91 00

PAINTING AND RE-PAINTING

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Work under this Section includes furnishing all labor, material, equipment and accessories necessary for completion of all painting and staining.
   02 Refer to paragraph 3.1 for list of items to receive paint.

C. Work Not Included:
   01 Shop coat of paint on metal, unless noted otherwise. Exception: Shop coated / primed metal components which have had primer removed due to repair of the component (i.e. hollow metal doors frames, etc.) shall be re-primed in the field prior to application of finish painting.
   02 Aluminum and copper, unless noted otherwise.
   03 Factory finished materials, products and equipment.
   04 Plastic clad educational equipment.
   05 Refer to Section 05500 – Miscellaneous Metals.

D. Related Work
   01 Section 04 20 00 – Unit Masonry.
   02 Section 05 50 00 – Metal Fabrications.
   03 Section 09 21 16 – Gypsum Board Assemblies.

1.2 RESPONSIBILITY OF COORDINATION

A. Coordinate the work specified herein with the following work:
   01 Provide information to preceding trades for proper preparation of substrate.
   02 Inspect substrate before proceeding to verify proper preparation.
   03 Notify Architect of any item to receive paint which may not be covered by a scheduled finish type. Architect will furnish appropriate specification.

1.3 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.
   01 Failure to follow required provisions may result in submittal being rejected without review.

B. Product Data: Submit manufacturer’s literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

01 Product data shall include test certificates / reports, other certifications and applicable documentation to demonstrate compliance and as required by the specification.

C. Samples: Submit full range of colors, patterns, textures and finishes available for selection, including the following:
   01 Color Chips: Provide complete duplicate sets of color chips for color selection.
   02 Small Applied Samples: Provide pieces of actual material on which paint will occur with minimum dry mil thickness of specified paint.
   03 Sheen Samples: Provide full range of varying sheens when sheens are controllable by intermixing.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including preparation, for all products and / or assemblies proposed to be furnished.

E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01 Include recommended cleaning products and instructions for use.
   02 Where applicable, provide recommended maintenance schedules and procedures.
   03 Provide paint cards indicating the following, upon submission of extra materials at the end of the project:
      a. Project and area
      b. Manufacturer's stock number and date of manufacturer
      c. Contents by volume, formula for pigment and vehicle constituents
      d. Color name and number.

F. Installed Samples: Provide large size samples for approval. Approved samples may be left in place as part of the work.
   01 Interior: One room and/or area, as selected by the Architect, shall be painted with materials specified or accepted and applied directly from container, un-thinned. After acceptance by Architect, room and/or area shall be standard of quality of entire project.
   02 Exterior: Three samples, 4'x4' each, of all exterior finishes, provided at the job site. Samples should represent each substrate. After acceptance by Architect, samples shall be standard of quality of entire project.

1.4 QUALITY ASSURANCE

A. Materials shall be applied directly from containers in which material is purchased. No exceptions.

B. Subcontractor shall provide to Owner and Architect a notarized certification that paint used is as specified in writing by the Architect.

C. Number of coats of each of several finishes shall be in accordance with detailed specifications, which will produce first quality finish if properly applied. If number of coats specified fails to produce a finish acceptable to Architect, this Contractor shall apply additional coat(s) at his own expense until an acceptable finish is achieved.

D. Provide primers and other undercoat paints produced by same manufacturer as finish coats. Use thinners recommended by paint manufacturer's printed instructions.

E. Deliver products to jobsite in unbroken containers bearing manufacturer's labels, intact and legible at time of use.

1.5 WARRANTY

A. The undertaking of a painting subcontract will indicate that the subcontractor will warrant the work specified herein for two years against becoming unserviceable or causing an objectionable appearance, resulting from either defective or nonconforming materials or workmanship.

B. Defects shall include by not be limited to the following:
   01 Discoloring noticeably by yellowing, streaking, blooming, changing color or darkening.
   02 Mildew.
   03 Peeling, cracking, blistering, alligatoring or releasing from the substrate.
   04 Chalking or dusting excessively.
   05 Changing sheen in irregular fashion.
   06 Change in sheen and / or color resulting from re-application of paint using a different application method than use on original coating(s) (i.e. brush touch-up on a surface originally sprayed).
   07 Softening or becoming tacky.
   08 Bubbling.

C. In the event of damage, immediately make all repairs and replacements necessary for approval of the Architect, and at no additional cost to the Owner.

1.6 PRODUCT HANDLING

A. Store only approved materials at the jobsite, storing only in a suitable and designated area restricted to the storage of paint materials and related equipment.

B. Temperature in the storage area shall be between 40°F and 110°F. Open and mix all materials in the storage area.

C. Use all means necessary to protect materials before, during, and after application, and to protect the installed work and materials of all other trades.

D. Apply water-base paints only when temperature of surfaces to be painted, and surrounding air temperatures are between 50°F (10°C) and 90°F (32°C), unless otherwise permitted by paint manufacturer's printed instructions.

E. Apply solvent-thinned paints only when temperature of surfaces to be painted, and surrounding air temperatures are between 45°F (7°C) and 95°F (35°C), unless otherwise permitted by paint manufacturer's printed instructions.

F. Do not paint in snow, rain, fog or mist, or when relative humidity exceeds 85%, or to damp or wet surfaces, unless otherwise permitted by paint manufacturer's printed instructions. Painting may be continued during inclement weather, if areas and surfaces to be painted are enclosed and heated within temperature limits specified by paint manufacturer, during application and drying periods.

1.7 EXTRA STOCK

A. Color cards with formula for each color used.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. All paint materials selected for coating systems for each type of surface shall be the product of a single manufacturer and shall, as a system, have flame spread, fuel contribution, and smoke density test results less than 25.

B. Paint materials listed herein, unless otherwise designated in the "Painting Schedule", are the products of Sherwin Williams (SW) or PPG Industries, Pittsburgh Paints (PPG)., and require no further approval as to manufacturer or catalogue number.

2.2 EXTERIOR PAINT MATERIALS

A. The following is a specification of typical exterior painted items and does not specifically include every item that is to receive paint.
   01 It should, however, establish type and quality of finish for all items normally included in a complete paint job.
   02 The paint materials listed in this section are a requirement of the District. Substitutions are not permitted.

B. Exterior Galvanized Metal:
   01 Primer:
      a. SW DTM Bonding Primer (B66A00050), or
      b. PPG PITT-TECH®Plus Waterborne DTM Acrylic Primer Finish 4020
   02 Finish:
      a. SW Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-1560 Series), or
      b. PPG PITT-TECH®Plus High Performance Waterborne DTM Acrylic Semi-Gloss Enamel 4216HP.

C. Field Weld Touch-up on Galvanized Metal:
   01 Primer:
      a. SW Pro-Cryl Universal Water Based Primer B66-310 Series
      b. PPG PITT-TECH® Plus Waterborne DTM Acrylic Primer Finish 4020
   02 Finish:
      a. SW DTM Acrylic Gloss Coating B66W100 Series
      b. PPG PITT-TECH® Plus High Performance Waterborne DTM Acrylic Semi-Gloss Enamel 4216HP.

D. Ferrous Metals:
   01 Primer:
      a. SW DTM Bonding Primer (B66A00050), or
      b. PPG PITT-TECH®Plus Waterborne DTM Acrylic Primer Finish 4020

02 Finish:
a. SW Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-1560 Series), or
b. PPG PITT-TECH®Plus High Performance Waterborne DTM Acrylic Semi-Gloss Enamel 4216HP.

E. Exterior Wood:
01 Primer:
a. SW S-100 Latex Wood Primer (B42W41), or
b. PPG SEAL GRIP® Interior/Exterior Acrylic Universal Primer/Sealer 17-921 XI
02 Finish:
a. SW A-100 Exterior Latex Satin (A8 Series), or
b. PPG SPEEDHIDE® Exterior 100% Acrylic Latex Satin 6-2045 XI Series.

F. Exterior Concrete Masonry Units:
01 Primer:
a. SW Loxon XP Waterproofing Coating (A24-1400 Series), or
b. PPG SPEEDHIDE® Interior/Exterior Acrylic Masonry Block Filler 6-15XI
02 Finish:
a. SW Loxon XP Waterproofing Coating (A24-1400 Series), or
b. SW Loxon Self-Cleaning Acrylic Coating (LX 14-50 Series), or
c. PPG SPEEDHIDE® Exterior 100% Acrylic Latex Satin 6-2045 XI Series.

G. Exterior Plaster (designated “Acrylic Finish”):
01 Primer:
a. SW PrepRite ProBlock Interior/Exterior Latex Primer/Sealer B51-600, or
b. PPG SEAL GRIP® Interior/Exterior Acrylic Universal Primer/Sealer 17-921XI
02 Finish:
a. SW Pro Industrial Multi-Surface Acrylic B66-1560 Series Semi Gloss.
b. PPG PITT-TECH® Plus Interior/Exterior Satin DTM Industrial Enamel 90-1110 Series

H. Exterior Traffic Marking Paint:
01 PPG ZONELINE® Traffic & Zone Marking Paint 11-53 Series
02 Colors
a. YELLOW for Parking Stripes
b. RED for Fire Lanes with WHITE lettering
c. WHITE for Band Practice Field Striping
d. BLUE and WHITE for Handicap Parking Striping

I. Zinc-Coated Metal:
01 Primer:
a. PPG PITT-TECH®Plus Waterborne DTM Acrylic Primer Finish 4020
02 Finish:
a. PPG PITT-TECH®Plus High Performance Waterborne DTM Acrylic Semi-Gloss Enamel 4216HP.

J. Concrete:
   01 Primer:
      a. SW Loxon XP Waterproofing Coating (A24-1400 Series)
   02 Finish:
      a. SW Loxon XP Waterproofing Coating (A24-1400 Series)

K. Fiber-Cement Material:
   01 Primer:
      a. SW Loxon Concrete & Masonry Primer Sealer (A24W8300)
   02 Finish:
      a. SW A-100 Exterior Latex Satin (A8 Series)

L. Exterior Steel Roof Structure, Roof Deck, and Cementitious Wood:
   01 Primer:
      a. See Product Specification
   02 Finish:
      a. PPG SPEEDHIDE® SUPER TECH® WB Interior Dry-Fog Flat Latex 6-725XI.

M. Exterior accessible ramps:
   01 SW ConFlex Flexible Concrete Waterproofer - Textured
   02 Color: SW 0006 Toile Red for ramps

N. Exterior Portable (temporary) building decking:
   01 SW ConFlex Flexible Concrete Waterproofer – Textured, or
   02 Valspar Satin Exterior Anti-Skid Porch and Floor
   03 Color: SW4026 – Slate Gray

2.3 INTERIOR PAINT MATERIALS

A. The following is a specification of typical interior painted items and does not specifically include every item that is to receive paint.
   01 It should, however, establish type and quality of finish for all items normally included in a complete paint job.
   02 The paint materials listed in this section are a requirement of the District. Substitutions are not permitted.

B. Interior Gypsum Drywall and Ceilings – Acrylic Finish:
   01 Primer:
      a. SW PVA Drywall Primer & Sealer (B28-8000series), or
      b. PPG SEAL GRIP® Interior/Exterior Acrylic Universal Primer/Sealer 17-921XL
   02 Finish:
      a. SW Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-1560 Series),or
      b. PPG PITT-TECH®Plus Interior/Exterior Satin DTM Industrial Enamel 90-1110 Series.

C. Interior Gypsum Drywall and Ceilings – Epoxy Finish:
   01 Primer:
      a. SW PVA Drywall Primer & Sealer (B28-8000series), or
      b. PPG SEAL GRIP® Interior/Exterior Acrylic Universal Primer/Sealer 17-921XL
   02 Finish:

a. SW Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-1560 Series),or
b. PPG PITT-TECH®Plus Interior/Exterior Satin DTM Industrial Enamel 90-1110 Series.

03 Use at bathrooms, locker rooms, showers, science labs, food service areas, and other moist / wet areas.

D. Interior Galvanized Metal:

01 Primer:
a. SW DTM Bonding Primer (B66A00050), or
b. PPG PITT-TECH®Plus Waterborne DTM Acrylic Primer Finish 4020

02 Finish:
a. SW Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-1560 Series),or
b. PPG PITT-TECH®Plus High Performance Waterborne DTM Acrylic Semi-Gloss Enamel 4216HP.

E. Interior Non-Galvanized Metal:

01 Primer:
a. SW DTM Bonding Primer (B66A00050), or
b. PPG PITT-TECH®Plus Waterborne DTM Acrylic Primer Finish 4020

02 Finish:
a. SW Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-1560 Series), or
b. PPG PITT-TECH®Plus High Performance Waterborne DTM Acrylic Semi-Gloss Enamel 4216HP.

F. On Metal with Shop Coat, use:

01 Touch-up Shop Coat with SW ProCryl Water Based Universal Primer B66-310 Series, 2.0 – 4.0 mils DFT.

02 2 coats – SW Pro Industrial Interior Multi-Surface Acrylic Semi-Gloss B66-1560.

03 Used for hollow metal door / window frames and miscellaneous steel items.

G. Interior CMU – Acrylic Finish:

01 Primer:
a. SW Heavy Duty Block Filler (B42W46), or
b. PPG SPEEDHIDE® Interior/Exterior Acrylic Masonry Block Filler 6-15XL

02 Finish:
a. SW Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-1560 Series), or
b. PPG PITT-TECH® Plus Interior/Exterior Stain DTM Industrial Enamel 90-1110 Series.

H. Interior CMU - Epoxy Finish – Wet Areas:

01 Primer:
a. SW Heavy Duty Block Filler (B42W46)

02 Finish:
a. SW Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-1560 Series)

03 Use at showers, food service areas, and other moist / wet areas as indicated.

I. Interior CMU - Epoxy Finish – Dry Areas:
01 2 coats Loxon Block Surfacer A24W200. Total 16 mils DFT As required to fill voids and provide a continuous surface.
02 2 coats – SW Water Base Catalyzed Epoxy B70 / B60. 3.0 mils DFT each coat.

J. Interior Wood – Enamel:
01 Primer:
a. SW Premium Wall and Wood Primer (B28W8111), or
b. PPG SEAL GRIP® Interior/Exterior Acrylic Universal Primer/Sealer 17-921 XL
02 Finish:
a. SW Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-1560 Series), or
b. PPG PITT TECH® Plus High Performance Waterborne DTM Acrylic Semi-Gloss Enamel 4216 HP

K. Interior Wood – Stained Transparent Finish:
01 Stain:
a. SW Minwax Performance Series Tintable Wood Stain, or
b. PPG DEFT® Oil Based Wood Stain DFT400 Series
02 Top Coat:
a. SW WoodClassics Waterborne Polyurethane Varnish Gloss (A68 Series), or
b. SW WoodClassics Waterborne Polyurethane Varnish Satin (A68 Series), or
c. PPG DEFT® Clear Polyurethane Interior Water Based Acrylic – Gloss DFT157

L. Interior Concrete Floors
01 Primer:
a. SW ArmorSeal Floor Plex 7100 Primier (B70W/B70V)
02 Finish:
a. SW Armorseal 1K Waterbased Urethane Floor Enamel (B65-775 Series)

M. Masonry/Concrete Ceilings
01 Primer:
a. SW Lexon Concrete & Masonry Primer Sealer (A24W8300)
02 Finish:
a. SW Pro Industrial Multi-Surface Acrylic Eg-Shel (B66-5600 Series)

N. Interior Plaster – Acrylic Finish
01 Primer:
a. SW PrepRite ProBlock Interior/Exterior Latex Primer/Sealer B51-600, or
b. PPG SEAL GRIP® Interior/Exterior Acrylic Universal Primer/Sealer 17-921XI
02 Finish:
a. SW Pro Industrial Multi-Surface Acrylic B66-1560 Series Semi Gloss.

b. PPG PITT-TECH® Plus Interior/Exterior Satin DTM Industrial Enamel 90-1110 Series

O. Interior Exposed Concrete (Columns, “RwKHu1 Concrete Wall or Ceiling Surfaces):
01 Primer:
a. PPG PERMA-CRETE® Interior/Exterior Alkali Resistant Primer 4-603XI.
02 Finish:
a. PPG PITT-TECH® Plus Interior/Exterior Stain DTM Industrial Enamel 90-1110 Series

P. Stage Floors:
01 SW Porch and Floor Enamel Interior Acrylic – Satin Finish

Q. Concrete or CMU Base at Mechanical Rooms and Mechanical Room Floor Penetrations
a. Trempro/Vulchem 640/642 one-part liquid polyurethane coating to provide a water-tight rubber membrane. Apply per manufacturer’s instructions at wall base to floor juncture 6” up wall and 6” on floor at all curbed Mechanical Rooms; and provide a 6” perimeter at all floor penetrations of Mechanical Rooms.

2.4 COLORS

A. Where specific finished paint colors are indicated or scheduled on the Drawings, provide paint colors accordingly.

B. Where specific finished paint colors are not indicated or scheduled on the Drawings, different colors may be selected for each room, and more than one color may be selected in each room.

C. Multiple paint colors and / or patterns on a single wall or plane shall be as indicated on the Drawings.

D. All piping in mechanical rooms shall be painted in their entirety in accordance with the following color schedule:

01	Natural Gas	Yellow
02	Domestic Cold Water	White
03	Domestic Hot Water	Pink
04	Heating Hot Water	Red
05	Condenser Water	Green
06	Chilled Water	Blue

PART 3 - EXECUTION

3.1 ITEMS TO RECEIVE PAINT

A. Generally, all unfinished items that are normally painted in any typical building, including but not limited to the following list:
01 All exposed structural steel

02 All exposed exterior steel; including masonry lintels, exposed steel structure, handrails and other exterior steel components. Do not paint galvanized steel.
03 All exterior wood.
04 All interior wood.
05 All conduit, outlet boxes and electrical cabinets exposed within a user occupied rooms; excluding those located in mechanical / electrical rooms.
06 All exposed pipe, plumbing and ductwork, including those located in mechanical rooms.
07 All new metal grilles, except aluminum, unless otherwise indicated.
08 All new exposed gypsum board surfaces, including all mechanical rooms.
09 All exposed exterior concrete masonry units, including all mechanical rooms.
10 All exposed interior concrete masonry units, including all mechanical rooms.
11 All exposed cementitious wood fiber materials at roof deck and walls.
12 Miscellaneous other items which normally require painting or are scheduled to be painted.
13 Consult plans, finish schedule, details and specifications for other trades as all items usually field painted or finish will be considered as part of the Contract.
14 All new exposed mechanical equipment and electrical equipment.
15 Any other material that is exposed to view that is not prefinished.

B. All work where a coat of material has been applied must be inspected and approved by the Architect, before application of succeeding specified coat, otherwise no credit for coat applied will be given.
01 Notify Architect when a particular coat has been completed for inspection and approval.
02 Apply coats of material in strict accordance with manufacturer's specifications, except where requirements of these specifications are in excess of manufacturer's requirements. Paint all sight exposed pipe and plumbing, only after all mechanical work and tests have been completed.

C. For surfaces scheduled to receive wall coverings or a wall protection system, refer to manufacturer’s installation instructions for appropriate preparation and primer.
01 If manufacturer’s recommended primer is different than specified in this section for painted walls, it shall be applied only to areas where wall coverings or wall protection system is to be installed. The remainder of the wall shall be primed using specified primers outlined in this section.

3.2 EXAMINATION

A. Verify surfaces and substrate conditions are ready to receive work as instructed by product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report conditions capable of affecting proper application.

C. Test shop applied primer for compatibility with subsequent cover materials.

D. Measure moisture content of surfaces using electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   01 Plaster and Gypsum Wallboard: 12 percent
   02 Masonry, Concrete, and Concrete Unit Masonry: 12 percent
   03 Interior Wood: 15 percent, measured in accordance with ASTM D4442.
   04 Exterior Wood: 15 percent, measured in accordance with ASTM D4442.
   05 Concrete Floors: 8 percent.

3.3 PREPARATION

A. Preparation of materials shall be in accordance with the manufacturer's standards and / or recommendations for the paint products / systems specified for each material.
   01 Field verify all conditions and requirements and coordinate with manufacturer as required for a proper installation.

B. General: Surface must be clean to ensure adhesion. Remove oil and grease with paint thinner. Wash off dirt with warm soapy water and rinse with clean water. Remove rust by wire brushing or sanding.

C. Unfinished Surfaces:
   01 Wood: Sand smooth and apply one coat of primer undercoat. After primer has dried overnight, putty nail holes and cracks, then spot-prime putty with primer. Again, allow the primer to dry overnight, sand lightly and topcoat.
   02 Masonry and Concrete: Remove form release compounds, efflorescence or cement dust on masonry and concrete by etching with a 10% solution or muriatic (Hydrochloric) acid. Power wash surface after etching with clean water, and paint while still damp, but within manufacturer's moisture tolerance. On surface where muriatic acid cannot be used to neutralize the efflorescence, remove the efflorescence by sanding, scraping or wire brushing, and apply a coat of masonry conditioner before painting. Fill voids and pores in concrete masonry and other porous masonry materials with latex block filler and allow to dry overnight before top coating.
   03 Iron and Steel: Prime with metal primer and allow to dry overnight before top coating.
   04 Galvanized Metal: Prime with galvanized metal primer and allow to dry overnight before top coating.

D. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

E. Surfaces: Correct defects and clean surfaces capable of affecting work of this section. Remove or repair existing coatings exhibiting surface defects.

F. Marks: Seal with shellac those which may bleed through surface finishes.

G. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

H. Aluminum Surfaces Scheduled for Paint Finish: Remove surface contamination by steam or high-pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.

I. Asphalt, Creosote, or Bituminous Surfaces Scheduled for Paint Finish: Remove foreign particles to permit adhesion of finishing materials. Apply compatible sealer or primer.

J. Insulated Coverings: Remove dirt, grease and oil from canvas and cotton.

K. Concrete Floors: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

L. Copper Surfaces Scheduled for Paint Finish: Remove contamination by stem, high pressure water, or solvent washing. Apply vinyl etch primer immediately following cleaning.

M. Copper Surfaces scheduled for Natural Oxidized Finish: Remove contamination by applying oxidizing solution of copper acetate and ammonium chloride in acetic acid. Rub on repeatedly for required effect. Once attained, rinse surfaces with clear water and allow to dry.

N. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.

O. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

P. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

Q. Plaster Surfaces: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

R. Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by wire brushing or sandblasting; clean by washing with solvent. Apply treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.

S. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.

T. Interior Wood Items Scheduled to Receive Paint Finish: Wipe off dust and grid prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.

U. Interior Wood Items Scheduled to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats.

V. Exterior Wood Scheduled to Receive Paint Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior paintable caulking compound after prime coat has been applied.

W. Exterior Wood Scheduled to Receive Transparent Finish: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior caulking compound after sealer has been applied.

X. Glue-Laminate Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.

Y. Wood Doors Scheduled for Painting: Seal wood door top and bottom edge surfaces with clear sealer.

Z. Metal Doors Scheduled for Painting: Prime metal door top and bottom edge surfaces.

3.4 ADDITIONS/RENOVATIONS

A. Extend existing paint and coatings installations using material and methods compatible with existing installations and as specified.

3.5 APPLICATION

A. General: Surfaces to be finished must be clean, dry, and free of dirt, oils, loose paint or any other contamination that would adversely affect adhesion, protective properties or appearance of the coating. Use tack cloth to remove dust and particles just prior to applying next coat.

B. Allow exterior paints to dry 72 hours between coats and interior paint to dry 24 hours between coats.

01 Allow all enamels and varnishes to dry 24 hours between coats. If enamel and varnishes are tacky after 24 hours, allow additional time until finish is dry.

C. Leveling: Apply with proper consistency and quality so paint flows out to a level surface free of brush and roller marks, bubbles, dust, runs, sags, and holidays. Spread evenly.

D. Appearance: Uniform color, texture and sheen.

E. Acrylic coating on concrete tilt-wall system to be applied with 1000psi airless sprayer with heavy duty texture gun.

F. Neatness: Paint shall not be smeared, spattered or run over adjoining colors or materials. Cut-on lines shall be straight.

G. First coat shall be white, unless otherwise specified.

H. Sand surfaces lightly between coats to achieve required finish

I. Apply each coat of paint slightly darker than preceding coat unless specified otherwise.

J. Where clear finishes are required, tint fillers to match wood. Work fillers into grain before set. Wipe excess from surface.

K. Prime concealed surfaces of interior and exterior woodwork with primer paint.

L. Prime concealed surfaces of interior wood surfaces scheduled to receive stain or varnish finish with gloss varnish reduced to 25 percent with thinner.

M. Finishing Mechanical and Electrical Equipment:
   01 Refer to mechanical and electrical specifications for schedule of color coding and identification banding of equipment, duct work, piping and conduit.

3.6 CLEANING

A. Collect waste material which may constitute fire hazard, place in closed metal containers, and remove daily from site.

END OF SECTION

SECTION 10 10 00

MISCELLANEOUS SPECIALTIES

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB - Instructions to Proposers and Section AF – Subcontractor and Manufacturer Prequalification for substitutions.

B. Scope of Work:
   01 Rapid Entry System (Fire Department Lock Box)
   02 Drying Rack
   03 Welding Fume Hood Table

C. Related Work:
   01 Section 10 44 00 – Toilet, Bath and Laundry Accessories.
   02 Section 11 31 00 – Residential Appliances.
   03 Section 23 35 16 – Welding Fume Exhaust System

1.2 SUBMITTALS

A. Provide all submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01 Include recommended cleaning products and instructions for use.
   02 Where applicable, provide recommended maintenance schedules and procedures.

F. Color / Finish Samples:
   01 Provide two (2) samples of each finish for selection by the Architect.
   02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
   03 Minimum size shall be 3” x 3” but must be large enough to convey attributes of the proposed product.

PART 2 - PRODUCTS

2.1 RAPID ENTRY SYSTEM (FIRE DEPARTMENT LOCK BOX)

A. Knoxbox
   01 Knox box 3200 series by Knox Company
   02 Surface/recessed mount with hinged door, with/without UL Listed Knox Tamper Alert.
   03 Provide Recess Mounting Kit 3290 for use in masonry construction as needed.
   04 1/4” plate steel housing, 1/2" thick steel door with interior gasket seal and stainless-steel door hinge.
   05 Box and lock UL listed. Lock to have 1/8” thick stainless-steel dust cover with tamper seal mounting capability.
   06 Exterior Dimensions:
   07 Surface Mount Body – 4”H x 5”W x 3-7/8”D.
   08 Recessed Mount Flange – 7”H x 7”W.
   09 Lock: UL Listed. Double-action rotating tumblers and hardened steel pins accessed by a biased cut key.
   10 Finish: Knox-Coat proprietary finishing process.
   11 Color: To be selected by architect from manufacturer’s standard colors
   12 Quantity:
      a. Provide one (1) recessed box at main entry
      b. Provide one (1) recessed box at Mechanical Room A134.
   13 Mount per manufacturer’s recommendation.
      a. Cabinet to be mounted 36 inches to 72 inches above the finished floor to comply with Harris County Fire Code requirements.
      b. If location is not noted on drawings, confirm location with architect in field.

B. Knox Padlock
   01 Knox Padlock, model 3782 by Knox Company
   02 Rated for exterior use – all weather conditions.
   03 2-3/8” H shackle clearance, 7/16” diameter stainless steel shackle
   04 Supply chain and padlock for each gate. Knox padlock to be interlocked with District chain and padlock.
   05 Interlock Knox Padlock with District-provided chain and pad lock at fire loop locations. District key will be located in Knox Box.
   06 If gate does not allow for chain and padlock, provide Knox Box 3200 Series as specified above. Coordinate with Owner for exact location and type.
   07 Quantity:
      a. Provide one (1) at each new traffic gate across fire lane, at new service yard gates or at new gates required for emergency egress.

2.2 DRYING RACK

A. DR-48-50 Rack-It Heavy Duty Drying Rack by A.W.T. World Trade Inc. or approved equal.
   01 Size: 51-3/4”W x 36-1/2”D x 68-1/4”H (to height of stop bracket)
   02 Material: welded steel
   03 Finish: Powder coat. Color to be selected by architect from manufacturer’s standard colors.
   04 Provide individually adjustable shelve springs.
   05 Provide heavy-duty casters
   06 Provide extra welded center metal bumpers.
   07 Number of shelves: 50
   08 Quantity: One (1). Install at location(s) noted on drawings.

2.3 WELDING FUME HOOD TABLE

A. Car-Mon Products, Inc. or approved equal.
   01 Model: TBL-44
   02 Size: 48”w x 48”d x 32”h
   03 Top Plate thickness: 3/4 inch minimum
   04 Legs: 3 inches x 3 inches
   05 Provide leveling feet with +/- 3” adjustment to allow for one table to be installed at ADA height (max 30” AFF).
   06 Location: Production System D128
   07 Quantity: Refer to drawings
   08 Fume hood shall attach to table with brackets. Refer to Section 23 35 16 – Welding Fume Exhaust System and mechanical drawings. If brackets are not provided with fume hood, provide attachment brackets needed for complete installation.

PART 3 - EXECUTION

A. Install in strict accordance with manufacturer’s installation instructions and recommendations specific to this installation.

B. Coordinate with other trades as required.

C. Adjust for proper installation.

END OF SECTION

SECTION 10 11 16

MARKER BOARDS

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide fixed dry erase marker boards as indicated on the Drawings.

C. Related Work:
   01 Section 04 20 00 – Unit Masonry.
   02 Section 09 21 16 – Gypsum Board Assemblies.
   03 Section 10 11 23 – Tack Boards.

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01 Include recommended cleaning products and instructions for use.
   02 Where applicable, provide recommended maintenance schedules and procedures.

F. Color / Finish Samples:
   01 Provide two (2) samples of each finish for selection by the Architect.

02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
03 Minimum size shall be 3” x 3” but must be large enough to convey attributes of the proposed product.

G. Close-out Submittals:
01 Provide updated as-built drawings and shop drawings.
02 Provide product and accessory model numbers and contact names/addresses for future re-ordering of parts by Owner.

1.3 REFERENCES

A. ASTM International:
01 ASTM E84 - Standard Test Method for Surface Burning Characteristics for Building.
02 Materials ASTM B221 - Standard Specification for Aluminum and Aluminum Alloy Extruded Bars, Rods, Wires, Profiles and Tubes.

B. American National Standards Institute (ANSI):
01 ANSI Z97.1 Safety Glazing Materials Used in Buildings – Safety Performance Specifications and Methods of Test.

C. Porcelain Enamel Institute:
01 PEI-1002 Manual and Performance Specifications for Porcelain Enamel Writing Surfaces.

D. GreenGuard environmental Institute:
01 GreenGuard Certified. UL2818-2013 Standard for Chemical Emissions for Building Materials, Finishes and Furnishings.

1.4 WARRANTY

A. Provide minimum of fifty (50) years or for the life of the installation on porcelain enamel.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Design of marker boards is based on products manufactured by Claridge.

B. The following manufacturers are acceptable provided they have a minimum of five (5) years’ experience and all proposed products meet or exceed all specified requirements.
01 Best-Rite.
02 Carolina Specialties.
03 Aarco Products, Inc.
04 ABC School Equipment (Platinum Visual Systems)
05 ADP Lemco Incorporated (ALine)
06 Ghent Manufacturing
07 Marsh Industries, Inc.
08 PolyVision

2.2 FIXED MARKER BOARDS

A. Design is based on Claridge "LCS3" liquid chalk writing system with magnetic surface.
   01 Material: 1/2 inch thick; three components, 24 gauge porcelain enameled on steel face, 1/2 inch core “Duracore”, and .015 aluminum sheet backing.
   02 Color: Porcelain plus 11096 medium gloss by Alliance.
   03 Refer to drawings for elevation, locations, and sizes.
   04 Accessories: Provide 12 markers per liquid chalk writing surfaces. Three each black, blue, red and green.
   05 All marker boards shall be factory built.
   06 Locations: Where indicated on the Drawings.
   07 Size(s): 4-feet high (unless noted otherwise) by length ~~As~~ indicated on the Drawings
   08 Do not provide chalk trough on marker boards in gymnasiums.
   09 Markings: At Orchestra Room only, provide music staff lines on first eight (8) feet of marker board on left side.

B. Trim:
   01 Marker Trough: Similar to Claridge Series 1, Type A, chalk trough under all marker boards.
   02 Map Rails: Similar to Claridge Series 1, Type A. Provide map rail across top of all marker boards.
   03 Spring Clips: Similar to Claridge No. 76M; provide four (4) heavy duty steel or aluminum per markerboard.
   04 Roller Brackets: Similar to Claridge No. 76 R.B.; provide one set at each marker board.
   05 Flag Holder: No. 76 F.H.; provide two (2) per classroom.
   06 Miscellaneous Trim:
      a. Provide closer and end cap pieces at their termination.
      b. Provide edge trim with ground
      c. Provide intermediate rail with ground across the top of markerboard.

C. Mounting:
   01 Mount factory assembled boards with mounting clips only; no adhesive is to be used. Mount all marker boards at 34" AFF to chalk rail unless noted otherwise.
   02 Provide mounting clips on all four sides of marker board, not just at top and bottom.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate with other trades as required for installation of blocking in walls to secure the marker board support brackets.

B. All marker boards and accessories shall be installed in strict accordance with manufacturer’s printed instructions. Rigidly anchored to backup materials. Set without mastic on gypsum board partitions.

C. Provide all grounds, brackets, anchors, trim, and accessories for a complete installation.

D. Install trim plumb with corners mitered. Secure trim with fasteners spaced 16 inches on centers maximum. **Ensure mounting clips are on all 4 sides of boards at proper spacing and not just at top and bottom**. Provide screws in lead shield on concrete walls and toggle bolts on drywall construction. Use concealed fasteners where possible.

END OF SECTION

SECTION 10 11 23

TACK BOARDS

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide all tack boards as indicated on the Drawings.
   02 Provide all tack strips as indicated on the Drawings.

C. Related Work:
   01 Section 04 20 00 – Unit Masonry.
   02 Section 09 21 16 – Gypsum Board Assemblies.
   03 Section 10 11 16 – Marker Boards.

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01 Include recommended cleaning products and instructions for use.
   02 Where applicable, provide recommended maintenance schedules and procedures.

F. Color / Finish Samples:

01 Provide two (2) samples of each finish for selection by the Architect.
02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
03 Minimum size shall be 3" x 3" but must be large enough to convey attributes of the proposed product.

G. Close-out Submittals:
01 Provide updated as-built drawings and shop drawings.
02 Provide product and accessory model numbers and contact names/addresses for future re-ordering of parts by Owner.

1.3 REFERENCES

A. ASTM International:
01 ASTM E84 - Standard Test Method for Surface Burning Characteristics for Building.
02 Materials ASTM B221 - Standard Specification for Aluminum and Aluminum Alloy Extruded Bars, Rods, Wires, Profiles and Tubes.

B. GreenGuard environmental Institute:
01 GreenGuard Certified. UL2818-2013 Standard for Chemical Emissions for Building Materials, Finishes and Furnishings.

1.4 WARRANTY

A. Provide minimum five (5) years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Design of tack boards is based on products manufactured by Claridge.

B. The following additional manufacturers are acceptable provided they have a minimum of five (5) years' experience and all proposed products meet or exceed all specified requirements.
01 Best-Rite.
02 Carolina Specialties.
03 Aarco Products, Inc.
04 ABC School Equipment (Platinum Visual Systems)
05 ADP Lemco Incorporated (ALine)
06 Ghent Manufacturing
07 Marsh Industries, Inc.
08 PolyVision

2.2 MATERIALS

A. Factory Built Tack Board (TB):
01 Design of tack board is based on Claridge 800 Series Tack Boards.
02 Frame:
a. Type 6063 alloy grade aluminum with T5 tempering in accordance with ASTM B221, with 201-R1 satin anodize finish.
b. Aluminum frame with 5/8" face trim (Type CO).

03 Tack Surface: Claridge “Fabricork” vinyl plastic mounted on 1/4 inch resilient cork over 1/4 inch hardboard underlayment (1/2 inch total thickness).
04 Patterns and colors as selected by the Architects from manufacturer’s full range of standard colors.
05 Size: 48” height by length indicated on the drawings. Where no length is indicated, provide 72” units.

B. Trim:
01 Extruded aluminum snap on trim with surface applied metal grounds.
02 Type: Similar to Series 270
03 Color: Dull satin anodized, natural.

C. Tack Strip:
01 Design is based on Claridge Hang-Tight Rail System 79.
02 Tackable cork strip insert.
03 Insert extrusion at bottom.
04 Size: 2” height; 1-1/8” depth.
05 Length: full length of associated marker board. Provide at all marker boards.

D. Mounting:
01 Mount factory assembled boards with mounting clips only; no adhesive is to be used.
02 Mount all tack boards at 34" AFF. unless indicated otherwise on drawings.
03 Provide clips on all four sides, not just at top and bottom.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate with other trades as required for installation of blocking in walls to secure the tack board support brackets.

B. All tack boards and accessories shall be installed in strict accordance with manufacturer’s printed instructions. Rigidly anchored to backup materials. Set without mastic on gypsum board partitions.

C. Provide all grounds, brackets, anchors, trim, and accessories for a complete installation.

D. Mount tackable wall surface to wall substrate in strict accordance with manufacturer’s standards and recommendations.

E. Install trim plumb with corners mitered. Secure trim with fasteners spaced 16 inches on centers maximum. **Ensure mounting clips are on all 4 sides of boards at proper spacing and not just at top and bottom**. Provide screws in lead shield on concrete walls and toggle bolts on drywall construction. Use concealed fasteners where possible.

END OF SECTION

SECTION 10 12 00

MANUFACTURED DISPLAY CASES

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide prefabricated display cases in sizes and locations as indicated on the Drawings.
   02 Provide integral lighting, if any, as indicated on the electrical Drawings.

C. Related Work:
   01 Section 04 20 00 – Unit Masonry
   02 Section 08 80 00 – Glazing
   03 Section 09 21 16 – Gypsum Board Assemblies.
   04 Section 12 32 16 – Manufactured Plastic-Lam Clad Casework.

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

E. Color / Finish Samples:
   01 Provide two (2) samples of each finish for selection by the Architect.
   02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
   03 Minimum size shall be 3" x 3" but must be large enough to convey attributes of the proposed product.

1.3 REFERENCES

A. ASTM International:
   01 ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   02 ASTM C1048 – Standard Specification for Heat-Treated Flat Glass – Kind HS, Kind FT Coated and Uncoated Glass.
   03 ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Design of display cases is based on products manufactured by Claridge Products and Equipment.

B. Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this section, provide all proposed products meet or exceed the specified requirements.
   01 Educational Equipment.
   02 Waddell Display Cases.
   03 Platinum Visual Systems.

2.2 MATERIALS – RECESSED DISPLAY CASES

A. Design of recessed six-foot-high display cases is based on Claridge series 390 Recessed Display and Trophy Cases.
   01 Provide in widths as indicated on the Drawings.

B. Aluminum:
   01 Trim shall be heavy gauge extruded aluminum and shall meet or exceed ASTM B221 alloy standards.
   02 Finish to be etched and anodized satin finish. (Provide bronze anodized to match door frame)

C. Wood Cabinet:
   01 Fabricate using 3/4" minimum type M2 medium density fiberboard (MDF) surfaced with horizontal grade laminate.
   02 Laminate shall be as selected by Architect from manufacturer’s full range of standard selections.
   03 Depth shall be 24”.

D. Glass:
   01 Doors shall be 1/4" clear tempered glass or 1/4" clear laminated safety glass.
   02 Glass shelves shall be 1/4" clear tempered glass.

E. Tackable Back Panel: Claridge Fabricork
   01 Vinyl covered 1/4" minimum cork surfacing.
   02 Color as selected by the Architect from manufacturer’s full range of color / pattern selections.

F. Housing and Trim:
   01 4” extruded aluminum perimeter trim.
   02 Continuous frame with mitered corner.

03 Provide 4” aluminum valance behind door assembly at cases designated with interior lighting.

G. Sliding Door Assembly:
01 Glass doors shall be fully enclosed in an extruded aluminum track frame.
02 Top and bottom tracks with ball bearing rollers.
03 Provide door pattern as indicated on the Drawings.
04 Provide plunger type, keyed locks at doors.
05 Master key all display cases to the same key.

H. Accessories:
01 Provide continuous shelf standards at 24” O.C. maximum; flush fit.
02 Provide corresponding shelf brackets; provide (4) brackets per standard.
03 At cases designated with interior lighting, provide LED tube type fixtures, spaced to provide even light across the width of the case.
04 Provide cylinder locks that accept a “Best” core, keyed to District master key system.

PART 3 - EXECUTION

3.1 PREPARATION

A. Thoroughly examine rough opening at display cases to determine they are complete and correct for proper installation of display case.

B. Notify Contractor of any discrepancies and do not proceed until all discrepancies are fully resolved.

C. At lighted display cases, coordinate with electrician for proper rough-in and final connection of lighting.

3.2 INSTALLATION

A. Install display cases plumb and level in strict accordance with manufacturer’s installation instructions and recommendations.

B. Install door assemblies in track system and fully test for proper installation; adjust as needed for smooth operation.

C. Upon completion of installation, thoroughly clean all surfaces.

END OF SECTION

SECTION 10 14 00

SIGNAGE

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Room identification signs and Interior way-finding directional signage.
   02 Fire Department Connections (FDC) signage.
   03 Fire Sprinkler Riser Room signage.
   04 Elevators: In case of emergency use stairs signage
   05 Roof hatch signage
   06 Brackets, clips, fasteners, anchors and all accessories required for proper installation of signage.

C. Related Work:
   01 Section 04 20 00 – Unit Masonry.
   02 Section 06 10 00 – Rough Carpentry
   03 Section 09 21 16 – Gypsum Board Assemblies.
   04 Section 09 70 00 – Digital Vinyl Wallcovering.
   05 Section 09 91 00 – Painting and Re-Painting.

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Indicate materials and finishes.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01 Include recommended cleaning products and instructions for use.
   02 Where applicable, provide recommended maintenance schedules and procedures.

F. Color / Finish Samples
   01 Provide two (2) samples of each finish for selection by the Architect.
   02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
   03 Minimum size shall be 3" x 3", but must be large enough to convey attributes of the proposed product.

G. Sample / Mock-Up:
   01 Provide a full size, completed sample of an interior room graphic sign.
   02 Provide one (1) actual sample of each type of room identification sign with specified finish.
   03 Provide rubbing of actual pattern of cast metal plaque for Architect's approval prior to casting.
   04 Provide one (1) 4-inch actual sample of cast metal letter in specified letter style and finish.

H. Close-out Submittals:
   01 Provide updated as-built record drawings and shop drawings.
   02 Provide product material colors, accessory model numbers and contact names/addresses for future re-ordering of parts by Owner.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):
   01 ASTM B209 Specification for Aluminum and Aluminum Alloy Sheet and Plate.
   02 ASTM E284 Standard Definition of Terms Relating to Appearance of Materials.
   03 ASTM E308 Computing the Colors of Objects by Using the CIE System.
   04 ASTM E1164 Standard Practice for Obtaining Spectrophotometric Data for Object-Color Evaluation.

1.4 QUALITY ASSURANCE

A. Work of this Section shall comply with applicable requirements of all state and federal codes, including, but not limited to, the American with Disabilities Act (ADA) and Handicapped Accessibility Act of Texas, as codified in Section 7, Article 601b, Vernon's Texas Civil Statutes.

PART 2 – PRODUCTS

2.1 INTERIOR ROOM GRAPHICS AND SIGNAGE

A. Design of interior room graphics and signage is based on products manufactured by South Texas Graphics (713) 467-4499.

B. Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this section, provided that the manufacturer has a minimum of five (5) years experience manufacturing products that meet or exceed the specified requirements and comply with Division 1 requirement for substitutions.
   01 A.R.K. Ramos Architectural Signage Systems (405) 235-5505.
   02 InPro Corporation (IPC); (800) 222-5566
   03 ProWorx Architectural Signage (713) 666-3131
   04 Riot Creative Imaging (713) 988-9200
   05 Sign-Ups and Banners (713) 682-7979
   06 Stanley Signature Signs (281) 395-6106
   07 The Southwell Co. (210) 233-1831

C. Materials and Fabrication:
   01 Constructed of one (1) or two (2) 0.030 thick, high-pressure laminates and laminated to a 1/8-inch-thick acrylic back.
   02 Signage shall have ½" radius corners with square-cut edges painted a color as selected by Architect.
   03 Demarcation line, if any, shall be in-filled to match copy color. Line shall be 3/16" engraved and painted.
   04 Signs mounted to glass shall be backed up with a blank panel to match the main color of the front sign to avoid seeing adhesive strips.
   05 Room Numbers, Symbols, and Restroom Copy:
      a. Shall be matte finished acrylic, raised, of color contrasting to face laminate.
      b. Characters and pictograms shall be chemically welded to the acrylic backing, through the face laminate.
      c. Room number at restroom signage to be ¼' engraved and painted.
      d. Symbols and text to be 1/32" raised and chemically welded through laminate face to core.
      e. Room numbers and restroom copy shall be accompanied by Grade II braile by means of "VisiTouch Duradot System" in accordance with ADA standards and requirements. Routed boxes or glued on dots are not acceptable.
   06 Lower or Secondary Copy:
      a. Shall be a minimum of 5/8 inch high, all caps, paint-filled in a color as selected by Architect.
      b. Engraved copy shall eight (8) stroke computer engraved, with adjusted consistent spacing. Rounded corners are not acceptable.
   07 Window (slotted) signs
      a. Shall be open on both ends for an insert by Owner.
      b. Window shall be a non-glare Lexan window, with an exposed color laminate behind in color as selected by Architect.
   08 Fasteners and accessories:
      a. 1/8-inch-thick, double-sided foam tape of type recommended to suit application and commercial grade silicone sealant.
      b. Back-up plates shall be supplied, where shown or required, for signage mounted on glass.

D. Mounting:
   01 Install interior signage with perimeter of foam tapes and center fill of clear silicone adhesive.

02 Locate on wall adjacent to strike side of door at consistent height and distance to door frame throughout the building.
03 Where sign is mounted on a glass surface, provide a solid back-up plate of same color to cover on the reverse side on glass.
04 In locations where a single door accesses two classrooms, the upper room number sign shall indicate the classroom farthest from the door, and the lower room number sign shall indicate the classroom closest to the door.

2.2 EXTERIOR ROOM GRAPHICS AND SIGNAGE

A. Fabrication: Match interior room graphics and signage as stated in paragraph above, except for material, which shall be as follows:
01 Material: Subsurface paint.
02 Colors: solid color to match specified laminate for interior signage as closely as possible.

2.3 MISCELLANEOUS SIGNAGE

A. Roof Hatch Signage
01 Signage material and attachment similar to room graphic signage.
02 Signage text to indicate roof has “20 Years Roof Warranty” and indicate Warranty start date’.
03 Graphic: Roof Access Inside
04 Where roof is accessed by stairs or ladder inside an interior room, signage is to be placed on the outer room door that leads to the room with the roof access ladder or stair.

B. Fire Department Connection (FDC) Signage
01 Signage material similar to Traffic signs – White background with red lettering.
02 Graphics: FDC Connection
03 Provide FDC sign as required by Fire Department/AHJ per each external fire connection visible from the vehicular pathway.

C. Fire Sprinkler Riser Room
01 Signage material and attachment similar to room graphic signage.
02 Signage material must be weather proof
03 Graphic: Fire Sprinkler Riser Room

D. Fire Alarm Control Panel
01 Signage material and attachment similar to room graphic signage.
02 Signage material must be weatherproof
03 Graphics: Fire Alarm Control Panel Inside
04 Color: Red with white letters or white with red letters.

E. Exit Door Number Signage
01 Provide .040 aluminum sign with number designation. Color to be gloss white.
02 Size of sign to be 6” high x 9” wide.
03 Text shall be 4-inch high, gloss black numbers / letters. Center text in sign.

04 Install in numerical order at all primary and secondary entry doors, including portable buildings, starting with the number “1”. Door numbers to begin at the main entry doors and continue clockwise from true north.
05 Adhere to door with double-sided tape.
06 Provide two (2) signs per door. One (1) shall be installed on exterior side of door and one (1) sign shall be installed on interior side of door.
07 Where sign is mounted on a glass surface, signs shall be back-to-back.
08 Do not install at doors that open only to a mechanical room.
09 Sign to be attached with mechanical fasteners or clear, double-sided VHB Tape.

PART 3 - EXECUTION

3.1 INSTALLATION - ROOM GRAPHICS / SIGNAGE

A. All room graphics shall be firmly affixed to substrate without use of mechanical fasteners. Install with double-sided foam tape and a bed of silicone sealant.

B. Mount graphics at a uniform height and distance from adjacent door jamb in accordance with ADA and Texas Accessibility Standards.

C. Where graphics are mounted on glass, provide a corresponding plastic laminate surfaces graphic blank on the inside of the glass.

END OF SECTION

SECTION 10 21 13.19

PLASTIC TOILET COMPARTMENTS

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide solid HDPE countertops and backsplashes in sizes and configurations as indicated on the Drawings.
   02 Provide solid HDPE bench tops in sizes and configurations as indicated on the Drawings.
   03 Provide solid HDPE tops at lockers in sizes and configurations indicated on the drawings.
   04 Provide hardware, fasteners, and accessories as required for a complete installation.

C. Related Work:
   01 Section 06 10 00 – Rough Carpentry
   02 Section 10 44 00 – Toilet, Bath and Laundry Accessories.

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

D. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01 Include recommended cleaning products and instructions for use.
   02 Where applicable, provide recommended maintenance schedules and procedures.

E. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembly components.

02 Show details of shop fabrications, connections and details.
03 Show details of field fabrications, connections and details.

F. Color / Finish Samples:
01 Provide two (2) samples for review by the Architect.
02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
03 Minimum size shall be 3" x 3" but must be large enough to convey attributes of the proposed product.
04 Provide a sample of each type of hardware associated with toilet partitions.

G. For warranties longer than one (1) year, submit a sample of the warranty proposed to be furnished.

H. Close-out Submittals:
01 Provide product and accessory model numbers and contact names/addresses for future re-ordering of parts by Owner.

1.3 REFERENCES

A. ASTM International (ASTM):
01 ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
02 ASTM D 1735 - Standard Practice for Testing Water Resistance of Coatings Using Water Fog Apparatus.
03 ASTM D 2247 - Standard Practice for Testing Water Resistance of Coatings in 100 percent Relative Humidity.

B. National Fire Protection Association (NFPA):
01 NFPA 286 - Standard Methods of Fire Test for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

C. Accessibility: Requirements of Americans With Disabilities Act (ADA) and Texas Accessibility Standards.

1.4 WARRANTY

A. Manufacturers Standard Warranty: For Solid Plastic HDPE Material: Against breakage, corrosion, and delamination for a minimum of 15 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Partitions and Hardware: Design is based on products / systems manufactured by Scranton Products

B. Other Acceptable Manufacturers: The following manufacturers are acceptable provided products furnished meet or exceed all specified requirements and attributes of the design basis product / system.
01 ASI Accurate Partitions Corp.

C. All components shall be products manufactured / provided by the manufacturer.

D. Manufacturer must have a minimum of five (5) years' experience manufacturing toilet partitions.

2.2 MATERIALS – COUNTERTOPS AND BACKSPLASHES

A. Design of plastic countertops and backsplashes is based on Scranton Products high density polyethylene (HDPE) solid plastic components / products.

B. All countertops, backsplashes, valances, and supports shall be solid HDPE plastic, and in the dimensions and arrangements indicated on the drawings.

C. Panels:
   01 Material shall be extruded high-density-polyethylene (HDPE) virgin resin materials in through colors that extend throughout the panel.
   02 Minimum Class B Fire Rated. ASTM-84-05.
   03 Conforming to requirements of NFPA 286.
   04 Countertop components shall have a finished thickness of minimum 1 inch with 1/4" radius corners and shall have a uniform flush front appearance.
   05 Backsplashes shall be 4" in height and shall be continuous at back walls and side walls (where applicable).
   06 Valance at leading edge of countertops shall be 3" to 4" and shall be continuous.
   07 Under counter supports shall be triangular in shape and shall extend no closer than 8" to the finish floor.
   08 Coordinate with other trades to provide plumbing fixture and toilet accessory cut-outs as required.

~~D.~~ Panel Finish: Color to be black paisley (no exceptions).

E. Countertops shall meet all requirements of ADA and Texas Accessibility Standards.

2.3 MATERIALS – BENCHES

A. Design of HDPE benches is based on Scranton Products high density polyethylene (HDPE) solid plastic components / products.

B. Panels:
   01 Minimum Class B Fire Rated. ASTM-84-05.
   02 Conforming to requirements of NFPA 286.
   03 Benchtop components shall have a finished thickness of minimum 1 inch with 1/4" radius corners and shall have a uniform flush front appearance.

C. Fabricate locker benches to sizes indicated in single lengths. Install on 16-inch CMU base; 30-36 inches on center.
D. Provide benches at showers as indicated
E. Color: Black Paisley (no exceptions)
F. Texture: Orange Peel

2.4 MATERIALS – LOCKER TOPS

A. Design of HDPE locker tops is based on Scranton Products high density polyethylene (HDPE) solid plastic components / products.

01 Material shall be solid, molded high-density-polyethylene (HDPE) virgin resin materials in through colors that extend throughout the panel.
02 Minimum Class B Fire Rated. ASTM-84-05.
03 Conforming to requirements of NFPA 286.
04 Thickness: minimum 1 inch with 1/4" radius corners
05 Top shall have a uniform flush front appearance.
06 Color: Black Paisley (no exceptions).
07 Texture: Orange Peel

2.5 MATERIALS – HARDWARE AND ACCESSORIES

A. All door hardware, mounting brackets and support brackets shall be manufacturer's standard products as required for issuance of specified warranty.
   01 Minor variations in hardware from other acceptable manufacturers are allowed, provided the proposed hardware meets or exceeds specified requirements; and meet the intent of the design and performance requirements.

B. Provide all accessories required for a complete installation as recommended by the manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in strict accordance with manufacturer's printed instructions.

B. Install where indicated on the drawings, and as indicated on the shop drawings. Anchor all components firmly in place for a long life under hard use, and in complete accordance with the manufacturer's recommendations.

C. Provide blocking/anchoring devices to secure to wall. Anchoring devices must be compatible to wall type to ensure adequate strength.

D. At drywall construction, treated 2X blocking shall be installed between studs and wall brackets/accessories shall be attached to blocking using 2" coated wood screws at 12" O.C. maximum spacing.

E. Provide pliable spacers between wall and backside of wall brackets / hardware to prevent crushing of wall finish.

3.2 CLEANING AND ADJUSTING

A. Defaced finish will not be permitted. Damaged, scratched or defective materials will be rejected, and shall be replaced with new materials.

B. Clean surfaces free of oil and imperfections.

C. Except for compartments for the handicapped, adjust doors to remain at a uniformly open position when unlocked.

END OF SECTION

SECTION 10 21 23

CUBICLE CURTAINS AND TRACK

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB - Instructions to Proposers and Section AF – Subcontractor and Manufacturer Prequalification for substitutions.

B. Scope of Work:
   01 Provide cubicle curtains and track assemblies at ROTC Stor/Dressing B129.

C. Related Work:
   01 Section 09 51 13 – Acoustical Tile Ceilings

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show dimensioned locations of assembled components.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01 Include recommended cleaning products and instructions for use.
   02 Where applicable, provide recommended maintenance schedules and procedures.

F. Color / Finish Samples
   01 Provide two (2) samples of each finish for selection by the Architect.
   02 Provide color charts showing Manufacturer's full range of colors.
   03 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.

04 Minimum size shall be 3” x 3”, but must be large enough to convey attributes of the proposed product.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Design of Cubicle Curtains and Tracks are based on products and assemblies manufactured by CS Cubicle Curtains.

B. Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this section, provided all proposed products meet or exceed the specified requirements.
01 General Cubicle Co.
02 Imperial Fastener Co.
03 Watrous, Inc.
04 Graber
05 A.R. Nelson Co., Inc.

C. Curtain:
01 General Cubicle Co.
02 Imperial Fastener Co.
03 Coral of Chicago,
04 Webb Manufacturing Co.

2.2 MATERIALS

A. Curtain Track - provide one at each curtain location as indicated on the Drawings:
01 Provide CS Cubicle Curtains #6063 suspended-mounted tracks of heavy extruded aluminum alloy 6063-T4, 1 3/8" x 3/4", slotted to receive roller carriers
02 Complete with accessories and components required for complete and secure installations including splices and end caps.
03 Corner Bends: Provide 16” to 18” radius corner bends fabricated from a continuous track to form a 90 degree “L”.
04 Carriers: CS Cubicle Curtains model 1062N, virgin nylon axle with nylon wheels complete with nickel plated brass bead chain and hook assembly. Provide one carrier per 6” of cubicle curtain width.
05 Operation: Hand drawn; provide 48 inch baton for hand operation
06 Finish clear anodized
07 Suspension Height: refer to Drawings for ceiling heights in room(s) to receive curtain track system.

B. Curtain:
01 Provide manufacturer’s standard 5 oz./Class “A” polyester fabric curtains at each section of track compartmentalized area. Curtain fabric shall be inherently flame resistant.
02 Curtains shall be lined with a liner with characteristics similar to cotton duck cloth to block light and shadows. Liner color to match curtain color.
03 Curtain shall be 20% wider than opening with flat panel and grommets at 6 inches on center.
04 The bottom of the curtain shall be 6 inches above the finish floor.
05 Curtain color shall be as indicated on interior finish schedule.

06 All cubicle curtains must meet NFPA 701 and must have NFPA 701 tags sewn on the bottom of each curtain. No exceptions.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine the acoustical ceiling grid installation and confirm it is suitable for installation of cubicle curtain track.

B. Coordinate with others as require to address any issues or discrepancies.

3.2 INSTALLATION

A. Install cubicle curtain track and curtain in strict accordance with manufacturer's instructions and final submittals.
   01 Using corner bends, splices and other accessories, track shall be continuous and suitable for smooth operation of curtain rollers.
   02 Confirm curtain track is properly installed prior to installation of curtain and rollers.
   03 Install curtain with hand pull at leading end.
   04 Install end caps to restrain curtain within track

B. Cycle curtain a minimum ten (10) times along the entire length and adjust as required for smooth, proper operation.

END OF SECTION

SECTION 10 22 13

WIRE MESH PARTITIONS

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide wire mesh partitions where indicated on the Drawings.
   02 Provide wire mesh doors integrated into partition system as indicated on the Drawings

C. Related Work:
   01 Section 03 30 00 – Cast-In-Place Concrete
   02 Section 04 20 00 – Unit Masonry
   03 Section 05 50 00 – Metal Fabrications
   04 Section 09 91 00 – Painting

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.
   04 Show plan(s) and elevation(s) of each partition, partition construction, door detail, hardware schedules, and finishes.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

E. Samples
   01 Provide two (2) samples of wire mesh fabric, minimum 12" x 12".
   02 Provide two (2) samples of each finish for selection by the Architect.
   03 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.

04 Minimum size shall be 2” x 2”, but must be large enough to convey attributes of the proposed product.

F. Close-out Submittals:
01 Updated As-Built drawings and shop drawings.
02 Product and accessory model numbers and contact names/addresses for future re-ordering parts by Owner.

1.3 REFERENCES

A. ASTM International
01 ASTM A36 - Structural Steel
02 ASTM A123 / A123M – Standard Specifications for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.
03 ASTM A153 / A153M - Standard Specifications for Zinc (Hot-Dip) on Iron and Hardware.
04 ASTM A307 - Carbon Steel Externally and Internally Threaded Standard fasteners
05 ASTM A385 - Providing High-Quality Zinc Coating (Hot Dip)
06 ASTM A325 - High Strength Bolts for Structural Steel
07 ASTM A500 - Cold formed welded and seamless carbon sheet structural tubing in rounds and shapes.
08 ASTM A510 - Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel
09 ASTM A992 - Steel for Structural Shapes for use in Building Framing

B. American Institute of Steel Construction
01 Steel Construction Manual, 15th Edition

C. American Welding Society
01 American Welding Society Structural Welding Code D11.1-77

D. American Iron and Steel Institute
01 Specification for Design Fabricated and Erection of Cold Formed Steel.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Design of wire mesh partitions is based on products manufactured by Acorn Wire and Iron Works.

B. The following additional manufacturers are acceptable provided proposed products meet or exceed all specified requirements.
01 Standard Wire & Steel Works
02 Wire Crafters
03 Central Wire & Iron Works
04 California Wire Products Corp.
05 G-S Company Wire & Iron Works
06 Indiana Wire Product
07 Kentucky Metal Products Co.
08 Superior Wire and Metal Products, Inc.
09 Jesco Wipco Wire & Iron Products

2.2 MATERIALS

A. Design of wire mesh partitions is based on Acorn Wire and Iron Works series 130A Standard Wire Mesh Partition system.

B. Wire Mesh Partitions:
   01 Mesh: 1 1/2 inch diamond mesh of not less than 10 gauge wire, complying with ASTM A510.
   02 Intermediate Bars: Pair of 1" x 1/2" x 1/8" cold rolled channels bolted together, allowing mesh to pass.
   03 Vertical Frames: Pair of 1-1/4" x 5/8" 'C' channels with I-beam stiffeners of 5/16" x 2" bars.
   04 Horizontal Frames: Pair of 1" x 1/2" x 1/8" channels.
   05 Top Caps: 2-1/4" x 1" cold rolled channels.
   06 Head Track (sliding): With four wheel ball bearing trucks.
   07 Erection Hardware: As necessary to secure and complete the installation.
   08 Floor Shoes: Weldable ductile iron, 1 1/4 inch high, with set screw adjustment.
   09 Galvanized steel handrail verticals (1 1/2" diameter), and horizontals with mesh panel inserts as shown on drawings.
   10 Provide horizontal bracing at walls as needed to produce strong durable installation, minimum every 8'-0" vertical.
   11 Height: Match existing

C. Wire Mesh Doors: Provide sliding doors at the dimensions and arrangements shown on the drawings and with the following features. Provide swing type doors as indicated on the Drawings.
   01 Framing: 1 1/4" x 1/2" x 1/8" hot rolled channels, with 1 1/4" x 1/8" flat bar cover on three sides.
   02 Provide 1 3/8" x 3/4" x 1/8" angle riveted to lock sides.
   03 Provide continuous head track and wheel trucks.
   04 Provide a continuous 12 gauge strike bar.
   05 Provide cylinder locks at swing gates and sliding doors. Locks shall be master keyed to MARKS Reversible gate locks and lever inside (#W-3791)
   06 Provide 2 pair of heavy duty hinges per leaf.

D. Finish:
   01 All components: Galvanized (not painted)

E. Miscellaneous Materials: Provide other materials not specifically described, but required for a complete and proper installation, including but not limited to grounds, brackets, anchors, trim, and accessories, as selected by the Contractor, subject to the approval of the Architect.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work.

B. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Coordinate partition installation with new/existing conditions at attachment as well as existing/new MEP or other systems in place.

B. Install the work of this section in strict accordance with the manufacturer's recommendations and shop drawings.

C. Set all partitions and components square and plumb.

D. Anchor all components firmly into position, true to line, and aligned horizontally and vertically.

E. Adjust operating components for optimum smooth function.

END OF SECTION

SECTION 10 44 00

TOILET, BATH AND LAUNDRY ACCESSORIES

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Furnish and install toilet and bath accessories as indicated or scheduled on the Drawings or specified herein.
   02 Installation of Items Provided by Owner:
      Soap dispensers - surface mounted.
      Paper towels dispensers - surface mounted.
      Toilet tissue dispensers- surface mounted.

C. Related Work:
   01 Section 04 20 00 – Unit Masonry.
   02 Section 09 21 16 – Gypsum Board Assemblies.
   03 Section 10 21 13.19 – Plastic Toilet Partitions.

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01 Include recommended cleaning products and instructions for use.

02 Where applicable, provide recommended maintenance schedules and procedures.

F. Color / Finish Samples:
01 Provide two (2) samples of each finish for selection by the Architect.
02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
03 Minimum size shall be 3” x 3” but must be large enough to convey attributes of the proposed product.

1.3 REFERENCES

A. ASTM international:
01 ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
02 ASTM A480 - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
03 ASTM B177 - Standard Guide for Engineering Chromium Electroplating.
04 ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

B. Compliance Standards: Comply with ANSI A117.1 and Texas Accessibility Standards (TAS)

1.4 QUALITY ASSURANCE

A. Manufacturer: Provide products manufactured by a company with a minimum of 10 years successful experience manufacturing similar products.

B. Single Source Requirements: To the greatest extent possible provide products from a single manufacturer.

C. Accessibility Requirements: Comply with requirements applicable in the jurisdiction of the project, including but not limited to ADA and ICC/ANSI A117.1 requirements as applicable.

D. Hazardous Materials: Comply with EU Directive “Restrictions of Hazardous Substances (RoHS) requirements.”

E. Design, furnish and keying of items shall be the same.

1.5 WARRANTY

A. Provide a written warranty for all provided stainless steel components covering the stainless steel finish against rust and / or rust spots for a period of two (2) years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. General design is based on products manufactured by Bobrick.

B. The following additional manufacturers are acceptable provided proposed products meet or exceed all specified requirements.

01 Bradley.
02 A & J Washroom Accessories.
03 Watrous, Inc.
04 GAMCO, General Accessory Mfg. Co.
05 American Specialties.
06 McKinney/Parker

C. Specified products listed by other manufacturers comply with district standards and are listed as no substitutions.

2.2 MATERIALS

A. Stainless Steel:
01 Alloy: AISI, Type 302 or 304 (18-08) ASTM A167.
02 Finish: No. 4 satin, unless otherwise specified.
03 Thickness: US Stainless 22 gauge minimum.

B. Aluminum:
01 Extruded: 6463-T5 alloy, anodized.
02 Cast: 356 or 356-T6 alloy.

C. Chromium Plating:
01 Method: Over nickel.
02 Standard: ASTM B177, Type SC 2.

D. Brass:
01 Cast or forged.
02 QQ-B-626C.

E. Mirrors: (Framed)
01 Standard: Federal Standard A-A-3002.
02 Glass thickness: 1/4 inch minimum.
03 Backing: Electrolytic copper.
04 Protection: Padding and filler strips.
05 Frame: Type 304 stainless steel, satin finish.

PART 3 - EXECUTION

3.1 MOUNTING LOCATIONS

A. Refer to drawings for mounting locations. When not shown, submit supplier's recommendations for locations and mounting height before proceeding.
01 For Owner Furnished Contractor Installed (OFCI) accessories, coordinate with Owner to obtain cut sheets and mounting instructions for all accessories.

B. Coordinate with other trades as required for opening sizes for recessed and semi-recessed accessories, installation of blocking in walls, and electrical connections to accommodate the installation of all toilet and bath accessories.
01 All wood blocking shall be treated.
02 Wood blocking shall be sized to accommodate anchorage of toilet accessory and provide minimum toilet accessory weight requirements.
Grab Bars: 250 LBS
Shower Seats: 360 LBS.

3.2 INSTALLATION

A. Install all toilet and bath accessories in strict accordance with manufacturer's standards and recommendations.

B. Use concealed fastening where possible; and where not possible, use approved theft-resistant type fasteners for anchoring toilet accessories.

C. Comply with ADA requirements.

D. Furnishing all opening, blocking and other components necessary for installation of all toilet accessories.

E. Use approved theft-resistant type fasteners. Do not use tape.

F. Mount accessories in location shown on drawings.

G. The following items will be furnished to the Contractor on a timely basis for installation into the work. Contractor shall install items using method indicated below:
   01 Soap Dispensers: Surface mounted, secured with screws.
   02 Toilet Paper Dispensers: Surface mounted, secured with screws.
   03 Paper Towel Dispensers: Surface mounted, secured with screws.

PART 4 - SCHEDULES

4.1 ITEM LIST

A. As a quality standard, model numbers shown are Bobrick Washroom Equipment unless indicated otherwise.

B. TA-1 – Wall Mounted Soap Dispensers:
   01 Owner Furnish – Contractor Installed.
   02 Mounting: Surface with concealed fasteners.
   03 Model: Symmetry 9902001.
   04 Locations: One (1) at each lavatory whether indicated on drawings or not.

C. TA-2 – Mirrors:
   01 Bobrick Model No.: Series 290 series 2436 stainless steel framed mirror without shelf.
   02 Mounting: Surface with concealed fasteners.
   03 Sizes Above Lavatories and Sinks: Minimum 24" x 36". Provide one (1) at each lavatory unless indicated otherwise on drawings. Refer to Drawings for other sizes.
   04 Full Height Mirrors: Minimum 24" x 72". Refer to Drawings for other sizes.

D. TA-3 – Paper Towel Dispenser:
   01 Owner Furnished - Contractor Installed
   02 Mounting: Surface with concealed fasteners
   03 Model: Baywest 86500
   04 Locations: Where indicated on drawings

E. TA-4: Recessed Waste Receptacle:
   01 Not Used.

F. TA-5 - Toilet Paper Dispenser - Roll:

01 Owner Furnished – Contractor Installed.
02 Mounting: Surface
03 Model: Kimberly Clark 09507
04 Locations: One (1) at each water closet.

G. TA-6 - Grab Bars – Toilet Compartments:
01 Standard Accessible Stall: Bobrick Model No.: B-6806 x 36 and x 42 in each 60" wide standard accessible stall.
02 Ambulatory Accessible Stall: Bobrick Model No.: B-6806.99 x 42 (2) in each 36" wide ambulatory accessible stall.
03 Mounting: Surface with concealed fasteners and theft-proof covers. Mount parallel to floor.
04 Size/Finish: 1-1/2 inch diameter satin finish stainless steel.
05 Wall Clearance: 1-1/2 inch between rail and wall.
06 Locations: Refer to drawings and code/ADA requirements.
07 Provide vertical sweep or bend on the vertical water supply to the flush valve if flush valve interferes with grab bar placement.

H. TA-7 - Mop and Broom Holder:
01 Bobrick Model No.: B-223 x 48, five holders.
02 Mounting: Surface.
03 Location:
a. One (1) at each Custodial Room,
b. Two (2) at Kitchen custodial room, whether indicated on drawings or not.

I. TA-8 - Clothes Hooks:
01 Bobrick Model: B-233
02 Mounting: Surface (48" AFF).
03 Location: One at each toilet stall door, whether indicated or not and one (1) at single use restrooms mounted on back of solid core wood door where restroom is being renovated.

J. TA-9 – Feminine Napkin Dispenser:
01 Model No.: B-2800 25.
02 Mounting: Surface with concealed fasteners.
03 Operation: Single coin (25 cents).
04 Capacity: 31 Napkins/22 Tampons.
05 Locations: One (1) at each renovated (staff) women's restroom and (student) renovated girl's restroom.

K. TA-10 - Feminine Napkin Disposal:
01 Mounting: Surface with concealed fasteners
02 Model No.: Continental 250C
03 Liners: Provide four (4) dozen liner units
04 Locations: One (1) at each renovated (staff) women's restrooms stall and (student) girl's restrooms stall, whether shown or not.

L. TA-11 - Grab Bars – Shower Compartments:
01 Not Used

M. TA-12 - Folding Bench – Shower Compartments:
01 Not Used

N. TA-13 - Shower Curtains and Rods:
01 Not USed

O. TA-14 – Electric Hair Dryer:
   01 Not Used

P. TA-15 - Electric Hand Dryer:
   01 Model: Saniflow M06AF-UL or Bradley 2902-280000 – 120V
   02 Mounting: Surface with concealed fasteners (maximum 4" protrusion from wall.
   03 Height above finish floor to activation device: Men at 46"; Women at 44".
   04 Locations: As indicated on drawings.

Q. TA-16 – Baby Changing Station:
   01 Not Used

R. TA-17 – Shower water retainer
   01 Not Used

S. TA-18 – Accessible Toilet Stall: General designation to identify assembly
   01 TA-5 - Toilet Paper Dispenser
   02 TA-6 - Grab Bars
   03 TA-8 - Clothes Hooks
   04 TA-10 - Feminine Napkin Disposal: (Women and girls Only)

T. TA-19 – Ambulatory Toilet Stall: General designation to identify assembly
   01 TA-5 - Toilet Paper Dispenser
   02 TA-6 - Grab Bars
   03 TA-8 - Clothes Hooks
   04 TA-10 - Feminine Napkin Disposal: (Women and girls Only).

U. TA-20 – Standard Toilet Stall: General designation to identify assembly
   01 TA-5 - Toilet Paper Dispenser
   02 TA-8 - Clothes Hooks
   03 TA-10 - Feminine Napkin Disposal: (Women and girls Only)

V. TA-21 – Accessible Sink: General designation to identify assembly
   01 TA-1 – Wall Mounted Soap Dispensers
   02 TA-2 – Mirrors
   03 TA-3 – Paper Towel Dispenser (staff restroom)
   04 TA-15 - Electric Hand Dryer (student restroom)

W. TA-23 – Transfer Type Shower Compartments: General designation to identify assembly

X. TA-24 – Roll-in Shower Compartments: General designation to identify assembly

Y. TA-25 – Marble Threshold

Z. TA-26 – Stainless Steel Wainscot Panels:
   01 Mounting: Surface
   02 Model No.: Custom
   03 Dimensions: 18 Gauge thick panels, 42 inches high x width of mop sink plus 12 inches, hem edges
   04 Locations: At each mop sink on two adjacent walls when on a corner unit, whether indicated on the drawings or not.

END OF SECTION

SECTION 10 44 13

FIRE EXTINGUISHERS AND CABINETS

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide fully recessed fire extinguisher cabinets where indicated on the Drawings.
   02 Fire extinguishers shall be Contractor furnished and Contractor installed.
   03 Provide fire extinguisher wall brackets at all mechanical rooms, main electrical room and central plant.

C. Related Work:
   01 Section 04 20 00 – Unit Masonry.
   02 Section 09 21 16 – Gypsum Board Assemblies.

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show locations of fire extinguisher cabinets and wall-mounted fire extinguishers.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01 Include recommended cleaning products and instructions for use.
   02 Where applicable, provide recommended maintenance schedules and procedures.

F. Color / Finish Samples:
   01 Provide two (2) samples of each finish for selection by the Architect.
   02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
   03 Minimum size shall be 3” x 3” but must be large enough to convey attributes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Design of fire extinguisher cabinets and fire extinguishers is based on products manufactured by JL Industries.

B. Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this section, provide all proposed products meet or exceed the specified requirements.
   01 J. L. Industries.
   02 Potter Roemer.
   03 Larsen’s Manufacturing Co.

2.2 MATERIALS

A. Fire Extinguisher Cabinets: Design is based on JL Industries Cosmopolitan Series, semi-recessed cabinets with 1-1/2” projection, model number 1037V–Vertical Duo.
   01 24” x 9-1/2” x 6” inside box dimension.
   02 Semi-recessed type with 2-1/2 inch return trim, rolled edge with eased corners.
   03 Door: Solid stainless-steel door (no glass insert), handle and silk screen lettering “Fire Extinguisher” in red color, unless directed otherwise by architect.
   04 Hinge: Continuous concealed piano hinge constructed of material which matches door and trim material.
   05 Provide a stain-finish pull handle and self-adjusting roller catch.
   06 Finish of Exterior: Stainless steel.
   07 Finish of Interior: Standard.
   08 All fire extinguisher cabinets shall be furnished with 10 lb. fire extinguisher.
   09 Box Construction: Double Wall of 18 gauge cold-rolled steel with baked acrylic enamel finish.

B. Wall Mount Brackets:
   01 Provide manufacturer’s standard fire extinguisher wall bracket specifically suited for support of wall mounted fire extinguishers.

C. Fire extinguishers shall be Contractor furnished and Contractor installed.

D. Fire Extinguishers (Standard):
   01 Multi-purpose dry chemical with UL 4A-60B:C and FM approved; UL 2A-10B:C for 5 and 10 lbs.
   02 Capacity: 5 lb. At mechanical rooms and direct wall mounted extinguishers; and 10 lb. at fire extinguisher cabinets.

03 Extinguishers are furnished for direct wall mounting and for fire extinguisher cabinets. Refer to drawings for location and quantity.
04 Provide initial inspection tag for each extinguisher.
05 Provide vinyl, self-adhesive extinguisher arrow sign to be installed on wall above directly wall-mounted fire extinguisher. Sign is not needed at fire extinguisher cabinet locations.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate with other trades as required for installation of rough openings / recesses in walls to receive fire extinguisher cabinets.

B. Coordinate with other trades as required for installation of all blocking in walls necessary for proper installation of fire extinguisher cabinets and wall mounted brackets.

3.2 INSTALLATION

A. Install fire extinguisher cabinets in strict accordance with manufacturer's standards and final reviewed submittals and per all applicable building and fire code(s).

B. Install fire extinguishers at all cabinets and wall hung locations.

C. Provide initial inspection tag for each extinguisher immediately prior to Substantial Completion.

END OF SECTION

SECTION 10 51 13

METAL LOCKERS AND BENCHES

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide standard metal lockers in quantities and locations as indicated on the Drawings.
   02 Provide athletic metal lockers in quantities and locations as indicated on the Drawings.
   03 Provide CMU benches with HDPE top in locker rooms and athletic areas in quantities and locations indicated on the Drawings.

C. Related Work:
   01 Section 03 30 00 – Cast-In-Place Concrete.
   02 Section 04 20 00 – Unit Masonry.
   03 Section 09 21 16 – Gypsum Board Assemblies.
   04 Section 10 21 13.19 – Plastic Toilet Partitions

1.2 SUBMITTALS

A. Provide all submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembly components.
   02 Show details of field fabrications, connections and details.
   03 Indicate locker numbering sequence.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

E. Color / Finish Samples:
   01 Provide two (2) samples of each finish for selection by the Architect.
   02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.

03 Minimum size shall be 2” x 2” but must be large enough to convey attributes of the proposed product.

F. Locations and quantity of ADA compliant lockers with approved graphics.

G. Locker/Lock Schedule: Manufacturer shall furnish the Owner prior to Substantial Completion a schedule for all lockers. The schedule shall contain the locker number, serial number of the lock installed, key number, or combinations, as applicable, for each locker. Furnish the schedule in spread-sheet form (i.e. Excel, etc). Furnish schedule in three (3) hard copies and flash drive. This information is to be given to CFISD Maintenance. Do not distribute to campus staff.

H. Keys: Contractor to provide CFISD Maintenance with all keys for distribution to Campus.

I. Close-out Submittals:
01 Updated as-built drawings.
02 Manufacturer contact names and addresses
03 Product and accessory model numbers and contact names/addresses for future re-ordering of parts by Owner.

1.3 WARRANTY

A. Warrant the work specified herein against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials or workmanship.
01 Athletic Lockers: Ten (10) years.
02 All other lockers: Two (2) years.

B. Defects shall include, but not be limited to the following:
01 Rapid deterioration of finish.
02 Loose or missing parts.
03 Non-functioning components and mechanisms.

1.4 OWNER STOCK

A. Provide 25 additional locks of each non-ADA type locks installed. Provide 10 additional ADA locks. Include keys for owner stock locks.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Design of Lockers are based on products manufactured by Republic Storage Systems, Inc.

B. Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this section, provide all proposed products meet or exceed the specified requirements.
01 Medart, Inc.
02 Penco Products.
03 Debourgh Manufacturing Co.
04 Art Metal Products Company

05 Lyon Metal Products, Inc.

2.2 LOCKER TYPES AND CONFIGURATIONS

A. Student Corridor Lockers:
01 Not Used

B. Standard Lockers:
01 Locker Type A – Art:
a. 6 tier, 72” overall height (excluding base and cap)
b. 12”w x 24”d x 12”h
c. Provide HDPE top
d. Key to existing master key system
e. Doors to be hinged at side.

02 Locker Type B – Food Service Staff:
a. 12”w x 12”d x 36”h.
b. Double tier 72” overall ht. (excluding base and cap).
c. Provide interior hooks and louvered door.
d. Provide sloped top.
e. Key to existing master key system.

C. Athletic Lockers:
01 Not Used

2.3 STANDARD LOCKERS

A. Materials:
01 Steel: All sheet steel used in fabrication shall be prime grade free from scale and imperfections and capable of taking a heavy coat of high gloss baked enamel.
02 Fasteners: Cadmium, zinc or nickel plated steel; bolt heads, slotless type; self-locking nuts or lock washers.
03 Equipment:
a. Hardware: Hooks and hang rods of cadmium plated or zinc plated steel or cast aluminum.
b. Handle: Stainless Steel recessed handle.
c. Number Plates: Each locker to have To have polished aluminum number plate with not less than 1/2 inch high etched numbers attached to door with two (2) aluminum rivets.

B. Fabrication:
01 General: Fabricate lockers square, rigid and without warp, with metal faces flat and free from dents or distortion. Make all exposed metal edges safe to touch. Weld frame members together to form rigid, one-piece structure. Weld, bolt, or rivet other joints and connections as standard with manufacturer. Grind exposed welds flush. Do not expose bolts or rivet heads on fronts of locker doors or frames. Each locker shall be fabricated from mild cold rolled sheet steel and capable of taking a high-grade enamel finish. Lockers shall be built on the unit principal – each locker shall have an individual door and frame, individual top, bottom, back and shelves with common intermediate uprights separating compartments.
02 Finishing: All locker parts to be cleaned and coated after fabrication with a seven (7) stage zinc/iron phosphate solution to inhibit corrosion, followed by a coat of high grade enamel electrostatically sprayed and

baked at 325 degrees F for a minimum of 30 minutes to provide a tough durable finish. Color shall be as selected by Architect from manufacturer's standard colors. All lockers shall be painted inside and out with the same color.

a. Two-Tone Color Combination: Shall be at no additional cost with the locker body, frame and trim chosen from one (1) standard color and the doors chosen from a second standard color.

03 Doors: Shall be 14 gauge, formed with a full channel shape on the lock side to fully conceal the lock bar, channel formation on the hinge side, and right angle formations across the top and the bottom. Door material/frame shall be continuous wrap from front to sides and to back minimum of one (1) inch on back of door (leaving no open edge of door frame material on back side of door – particularly so at hinge side of door at top and bottom). Standard locker doors shall have louvers near the top and bottom of each locker.

04 Frame: Fabricate of 14 gauge (minimum) channels, with integral continuous door stop / strike formed on vertical members.

05 Wardrobe Doors: Outer door to be fabricated from single sheet prime 14 gauge with 7/8 inch double bends at top and bottom and 3/4 inch double bends at the sides with a minimum 3 inches wide 18 gauge full height channel door stiffener MIG welded to the inside of door face at the hinge side as well as the top and bottom return bends.

06 Handles: Shall be made from sturdy zinc die-cast case material. Padlock attachment with 3/8 inch diameter hole positioned so that the fixed handle case provides a padlock strike.

07 Latch Assembly: All lockers shall be equipped with a positive automatic pre-locking device whereby the locker may be locked while door is open and then closed without unlocking and without damaging locking mechanism. Latching shall be a one-piece, pre-lubricated, spring steel latch, completely contained within the lock bar under tension to provide rattle-free operation. There shall be three (3) latching points for lockers over 48 inches in height and two (2) latching points for all tiered lockers 20 to 36 inches in height. 12 inch box lockers to have one latch. Latch must be able to accept specified built-in combination lock (no exceptions). Provide lift latch lock style only (no exceptions).

08 Door Hinges: Shall be piano-style, continuous hinges – no exceptions. Top hinge lockers are now allowed.

09 Body: Fabricate back and sides of 16 gauge (minimum) sheet steel, with double flanged connections extending full height, form top, bottom and intermediate tier dividers of 16 gauge (minimum) sheet steel with single return bends at all sides. Bolt to front horizontal frame members in addition to side panels. Form hat shelves at single tier lockers of 16 gauge (minimum) sheet steel with single bends at sides and back and a double bend at front. All bolts and nuts shall be zinc plated.

10 Locks:

a. Provide one accessible lock at each ADA / accessible locker per governing authorities.

b. Each locker shall have integrated combination lock.

c. At all non-ADA lockers: use MasterLock #1630 (no exceptions). Key to existing Master Key System.

d. At all ADA lockers: Use MasterLock 1636 (no exceptions). Provide 10 copies of ADA key for each ADA lock. ADA lock shall be keyed to SL11 master system.

e. For renovations:

1. Keep existing master key system.

2. Extend existing locker codes with Master Lock

3. Send all locks to CFISD first for their maintenance department to log and key them prior to installation by Contractor.

11 Equipment: Furnish each locker with the following items, unless otherwise shown.
   a. Single tier lockers over 42 inches in height: Hat shelf, one (1) double prong (single prong in 9 inch width) back hook and not less than two (2) single prong wall hooks in each compartment. (Two (2) single prong wall hooks only at nine (9) inches wide).
   b. Double and triple tier lockers: One (1) double prong (single prong in 9 inch width) back hook and not less than two (2) single prong wall hooks in each compartment. (Two (2) single prong wall hooks only at nine (9) inches wide).
   c. Lockers under 20 inches in height are not to be equipped with hooks.
   d. All hooks should be made of steel.
   e. Shelf at ADA lockers to be adjustable.

12 Finished End Panels (if applicable): Shall be “Boxed” type formed from 16 gauge cold rolled steel with 1/2 inch O.D. double bends on sides and a single bend at top and bottom with no exposed holes or bolts. End panels must be formed with slope at top to cover the ends of the continuous slop tops. Finish to match lockers. Provide at all exposed ends.

13 Continuous Slope Tops (if required): Not less than 16 gauge sheet steel, approximately 18 degrees pitch, in lengths as long as practical but not less than four (4) lockers. To be installed in addition to the locker flat top with end closures for support. Finish to match lockers.

14 Flat tops: Provide 1-inch HDPE finished top as noted on drawings.

15 Fillers: Provide where indicated, of not less than 18 gauge sheet steel, factory fabricated and finished to match lockers.

16 Frame Hooks – Silencers: Frame hooks to accept latching shall be of heavy gauge steel, set close in and welded to the door frame. Continuous vertical door strike shall protect frame hooks from door slam damage. A soft rubber silencer shall be provided and securely installed on each frame hook.

17 Catch at PE lockers: Friction type

18 Locker tops: wall-mounted lockers shall have sloped tops. Lockers not mounted to walls shall have flat tops constructed on HDPE plastic per section 10 21 13.19 – Plastic Toilet Partitions. Color to be black & white paisley only.

19 Approved Product: “Republic Heavy Duty Corridor Lockers” in types, sizes, and locations as shown on drawings.

20 Provide required accessible quantity of each type of locker (minimum 5 percent – rounded up in each cluster) to comply with ADA and TAS requirements. Include intermediate bottom shelf and ADA / TAS approved locking mechanism. Accessible lockers shall have recessed handles and shall be either single tier or the lower opening of a double-tier locker. Doors assigned for handicapped use shall have an appropriate accessibility identification symbol. Shelves and coat hooks in ADA designed lockers are to be installed within ADA-compliant reach range.

2.4 LOCKER BASES

A. All lockers shall be installed on a continuous, cast-in-place concrete base in configuration as indicated on the Drawings.

01 If not indicated, base shall be 4 inches tall by depth required by locker manufacturer for proper installation.

B. Concrete bases shall include continuous, embedded treated 2x lumber for anchoring lockers.

C. Coordinate with Contractor / other trades as required for proper installation of locker bases.

2.5 LOCKER ROOM BENCHES

A. Materials:
01 Type: Benches that are shown on the drawings as CMU with HDPE top, all benches shall be solid HDPE topes with rounded edges (reference section 10 21 13.19 for material specifications).
02 Size:
a. ADA benches: 20” deep x 42” long in accordance with ADA / TAS requirements.
b. Non-ADA benches: 9-1/2” deep x length shown on drawings. If indicated on drawings, provide 12” wide bench x length shown.
03 Bench Height: as indicated on drawings.
04 Typical at all student and staff locker room areas.

PART 3 - EXECUTION

3.1 PREPARATION / COORDINATION

A. Coordinate with Contractor and other trades as required for proper installation of concrete bases required at lockers.

3.2 INSTALLATION

A. Assemble lockers in accordance with the manufacturer’s written instructions. Lockers shall have no sharp metal edges.

B. Install lockers and benches plumb, level, and flush in the locations shown on the drawings in accordance with the manufacturer’s instructions.

C. Anchor lockers to the floor and wall as recommended by the manufacturer.

D. Install slope hoods, metal fillers, end panels and trim to close openings, and accessories using concealed fasteners. Provide flush hairline joints against adjacent surfaces.

E. Install number plates in order as directed by the Architect.

F. Install benches where indicated on the Drawings. Secure bench to floor to provide fixed installation.

G. Utilize all bolt holes from top to bottom when assembling and adjoining lockers together.

H. Install 1-inch thick HDPE tops on all back-to-back lockers.

3.3 ADJUST AND CLEAN

A. Adjust doors and latches to operate without binding and positive latching and automatic locking.

B. Touch up marred finishes with factory supplied paint.

END OF SECTION

SECTION 10 56 26

INDUSTRIAL STORAGE SHELVING

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide all steel shelving units indicated on the Drawings or specified here in.

C. Related Work:
   01 Section 04 20 00 – Unit Masonry
   02 Section 05 50 00 – Metal Fabrications.
   03 Section 09 21 16 – Gypsum Board Assemblies

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

E. Close-out Submittals: Provide product and accessory model numbers and contact names/addresses for future re-ordering of parts by Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The following additional manufacturers are acceptable provided proposed products meet or exceed all specified requirements.
   01 Penco.
   02 Lyon-MF.
   03 Dixie Shelving Co.
   04 Art Metal/List Industries, Inc.
   05 Montel, Inc.
   06 Republic Storage Systems
   07 Inco Metal Products

2.2 MATERIALS

A. General:
   01 Adjustable heavy duty open shelves.
   02 Nominal Height: 84".
   03 Minimum Shelf Capacity: 400 lbs. uniformly distributed load.
   04 Plan size as indicated on drawings. Depth = 16" typ. (24" at art rooms, custodial and book room areas).

B. Shelf Unit Components:
   01 Corner Post: 14 gauge minimum.
   02 Shelf Gauge: 16 gauge minimum.
   03 Shelves: Seven shelves total, including top and bottom.
   04 Two pair side sway braces per unit.
   05 One pair back sway braces per unit.

C. Sizes: Provide sizes (width and depth) as indicated on the Drawings.

D. Finish: Gray powder coat paint, factory applied. Standard factory applied paint, color as selected by Architect.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install shelving units in accordance with manufacturer's printed instructions.

B. Secure wall units to walls in a minimum of two places per unit. Connection can be made with angle brackets.
   01 At metal framed wall conditions, assure connection at wall is made into a stud.
   02 Connection into gyp board (alone) or use of expansion anchors is not acceptable.
   03 Single line installation against walls shall be braced to walls using threaded anchors (block walls) or bolted in wall/in wall blocking (gypsum board wall). HAMMER DRIVE ANCHORS ARE NOT ALLOWED. Back-to-back installations shall be braced together.

C. Refer to Drawings for locations and quantities.

D. Install bottom shelf 4 inches above finish floor.

E. Shelving in custodial rooms to be installed on 4-inch concrete pad, whether indicated on drawings or not.

END OF SECTION

SECTION 10 73 26

ALUMINUM WALKWAY COVERINGS

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide walkway canopy systems / assemblies in the configurations and heights indicated on the Drawings.
   02 All walkway canopies shall be engineered by structural engineer licensed in the state of Texas.
   03 All walkway canopies shall be engineered to meet minimum wind load criterion established for this project.
   04 Design of walkway column / post footings shall be included. Coordinate with the Contractor for installation responsibility.
   05 May also be referenced as aluminum canopy, trellis or awning.

C. Related Work:
   01 Section 01 11 23 – Codes
   02 Section 02 32 00 – Geotechnical Report.
   03 Section 03 30 00 – Cast-In-Place Concrete.
   04 Section 32 13 13 – Concrete Paving.
   05 Division 26 – Electrical.
   06 Underground Storm Sewer System.

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details, including any internal drainage system details.
   03 Provide calculations demonstrating compliance with wind load and other requirements.
   04 Shop drawings shall be sealed and signed by a Texas registered engineer.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.

01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
02 Generic details that do not depict actual conditions shall not be acceptable.

E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
01 Include recommended cleaning products and instructions for use.
02 Where applicable, provide recommended maintenance schedules and procedures.

F. Color / Finish Samples:
01 Provide two (2) samples of each finish for selection by the Architect.
02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
03 Minimum size shall be 3" x 3" but must be large enough to convey attributes of the proposed product.

G. Close-out Submittals:
01 Updated As-Built drawings and shop drawings
02 Manufacturer contact names and addresses
03 Product and accessory model numbers and contact names/addresses for future re-ordering of parts by Owner.

1.3 REFERENCE STANDARDS

A. ASTM International
01 ASTM B221 - 08 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
02 ASTM B429/B429M – 06 Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.

B. Aluminum Association: AA-MIO-C22-A21: Aluminum Design Manual 2005, The Aluminum Association.

C. ASCE/SEI 7-05 Minimum Design Loads for Buildings and Other Structures.

D. AAMA – American Architectural Manufacturers Association.

E. AWS D1.2/D1.2M:2003, Structural Welding Code – Aluminum.

F. Underwriters Laboratories: Class A Fire Rating.

1.4 SYSTEM REQUIREMENTS

A. Aluminum walkway covers shall be a complete, engineered canopy system comprised of support columns, cross beams, bent framed, decking and fascia trim.
01 Refer to Drawings to layout, configurations and heights.

B. All aluminum walkway covers shall be designed and engineered to withstand wind loads per IBC codes and as specified in section 01 11 23 – Code Summary.

C. System shall be designed in accordance with FM Global I-90 wind uplift requirements.

D. System shall be designed to comply with Underwriters Laboratories Class 'A' Fire Rating requirements.

E. All components shall be sized to comply with live load and wind load requirements of the project and shall not be less than the dimensions shown on the plan or specified in this section.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Design of aluminum walkway canopies is based on products / systems / assemblies of Avadek Walkway Cover Systems and Canopies.

B. The following manufacturers are acceptable to provide work of this section provided all proposed products meet or exceed specified requirements:
   01 Aluminum Techniques.
   02 Canopy Solutions
   03 Superior Metal Products Co.
   04 American Walkway Covers, LLC.
   05 Childers Carports & Structures, Inc.
   06 Dittmer Architectural Aluminum.
   07 Mapes Industries, Inc.
   08 Peachtree Protective Covers, Inc.
   09 Perfection Architectural Systems, Inc.

2.2 MATERIALS

A. Aluminum extrusions shall be as designed by manufacturer and appropriate for intended use.
   01 6005-T6.
   02 6061-T6.
   03 6063-T5.
   04 6063-T6.
   05 All alloys shall be in accordance with ASTM B221.

B. Provide 6" x 6" and 6" x 10" aluminum beams, or larger if required by engineering, draining the canopy as shown on drawings.
   01 If drainage is not indicated, provide concealed drainage at least at every other column / post on one side of the walkway canopy only.
   02 Drainage shall be away from the building; and conform to drainage patterns as indicated on the Drawings.
   03 Configuration to be as shown on the drawings.

C. Structure shall be designed by the manufacturer to withstand walking on top, heavy hail, and hurricane winds, in the configurations as shown on drawings.

D. Provide concealed drainage from deck into gutters and into bents, for discharge at slab, trench drain or subsurface level as indicated on the Drawings.
   01 At Surface Drains: Provide angled, aluminum diverter welded in the base of the column to divert water onto adjacent surface.
   02 At Trench Drains: Provide extended column to extend flush with top of trench drain cover.

03 At Subsurface Drains: Provide a horizontal, round aluminum, 12” long boot welded to side of column at required elevation to interface with subsurface storm drain system. Provide threaded end for PVC/SDR fitting to connection to subsurface storm system. Flexible Fernco or equal type fittings are NOT allowed. Coordinate with other trades as required for size, location and depth.

E. Bent Construction: Beams and columns shall be welded into one piece rigid bents in the manufacturer’s shop. Extended structural ties shall be rigidly installed in tops of all beams, also serving as closures between draining deck sections.

F. Horizontal 6” x 6” U-beams and vertical 6” x 6” tubes are to attach to columns and each other with concealed fasteners to recessed aluminum plates.

G. Roof Deck:
01 Minimum Panel Overall Profile Height: 4-1/2”.
02 Extruded 2-3/4-inch-thick sections shall interlock in a homogeneous structural unit, with joint designed and fabricated into a structurally rigid shape which is self-flashing.
03 No protruding ribs on the underside of deck is permissible.
04 Deck thickness shall be a minimum of .080” thick.

H. Fascia: to match existing unless indicated otherwise on drawings.

I. Finishes: finishes of each component shall be as selected by the Architect from manufacturer’s full range of colors samples.
01 Satin-etched clear anodized – Aluminum Association Specification AA-M10-C22-A31 (provide one (1) year finish warranty).
02 Satin-etched bronze anodized - Aluminum Association Specification AA-M10-C22-A44 (provide one (1) year finish warranty).
03 Super-Polyester 2-coat system - Aluminum Association Specification AAMA 2604-21/Color: per color schedule (provide ten (10) year finish warranty).

J. Columns: All columns shall have radius corners.

K. Beams: Beams shall be open at the top to drain canopy system internally into columns.

L. Expansion Joints: Provide expansion joints as required. Expansion joints shall have no metal-to-metal contact.

M. Flashing: Shall be 0.040 inch aluminum fabricated to prevent leakage of water between canopy and adjacent structures, where applicable.

N. Bird Blocker: Provide .080 aluminum bird screens/closer trims at deck flutes and gutter beams to close off ~~spaces~~ voids from nesting birds.

O. Leaf guards: Provide .080 aluminum perforated leaf guards at locations where trees are adjacent to canopy. Leaf guards to match finish of canopy.

P. Overflow drain: Provide overflow drains to match finish of canopy.

2.3 FOUNDATIONS

A. Design of footings at canopy columns shall be the responsibility of the canopy manufacturer.

B. Footings shall be designed to support all dead loads, live loads at a minimum of 20 PSF, and as required to meet specified wind load / uplift.

C. Coordinate as required for preparation and installation of canopy footings.

2.4 DRAINAGE SYSTEMS

A. Drainage Above Grade / Flatwork:
   01 Provide openings in base of columns: with bottom of opening +/- 4” above grade or concrete flatwork where indicated on the Drawings.
   02 If not indicated, provide concealed drainage at a minimum of every other column on canopy side away from the building toward the nearest paving.
   03 Provide a minimum 1/4" thick diverter plate welded continuous into base of drainage columns to provide positive diversion of water out of drainage opening.

B. Drainage Below Grade:
   01 Provide opening in drainage columns below grade.
   02 Provide a minimum 1/4" thick diverter plate welded continuous into base of drainage columns to provide positive diversion of water out of drainage opening.
   03 At column opening, provide a round aluminum boot, minimum 12” in length, welded continuous onto face of column at drainage opening below grade and threaded on the outer end to connect with PVC/SDR female threaded fitting.
   04 Diameter of boot shall be equal to sub-surface drainage pipe shown to connect to drainage column. Refer to Civil Storm Sewer Drawings.
   05 Connection to underground storm drain pipe shall be accomplished with a female threaded PVC/SDR fitting. Flexible Fernco or equal type fittings are NOT allowed.
   06 Column footing shall be below drainage connection; adjust column length as required.
   07 Coordinate with other trades as required to properly locate and connect the drainage boot.

2.5 FASTERNERS, CONNECTIONS, AND FITTINGS

A. Bolted Connections: All bolts, nuts, washers, and screws used in joining the members shall be stainless steel up to 3/8” diameter. Over 3/8” diameter may be Hot Dipped Galvanized.

B. General Contractor shall provide structural attachment points flush with the outside surface of the building.

C. Rafters shall be heliarc welded to wall mounting plates, which are bolted to walls.

D. Beams are to be fastened to rafters with concealed clips.

E. Blades to be mechanically fastened to structure with stainless steel screws, concealed were able.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install at locations shown on the drawings.

B. Provide concrete footings in accordance with engineer's signed and sealed shop drawings.

C. Install canopy in strict accordance with manufacturer's recommendations.

D. Coordinate dimensional requirements prior to fabrication.

E. The components and accessories are to be supplied and installed by the manufacturer.

3.2 ERECTION

A. Erection shall be in accordance with manufacturer's recommendations.
01 Erectors shall be manufacturer approved.

B. Erect after all structural concrete and masonry in vicinity is complete and washed down.

C. Column sleeves shall be furnished by the manufacturer and installed by the General Contractor, to elevations and dimensions on approved shop drawings.

D. Erect all bents straight and true. Protect columns with heavy plastic sheeting.

E. Install all flashing required at the juncture of deck sections.

F. Install rain caps over draining sections of the deck.

G. Downspout columns shall be filled with grout to the discharge level to prevent standing water. Downspout deflectors shall be installed after grouting.

H. Bird blockers shall be installed at all upper ribs of deck above C-Channel beams.

I. If canopy is suspended or a cantilever type, all wall anchors and plates shall be furnished by the manufacturer and the installation coordinated with the General Contractor.

3.3 CLEANING AND PROTECTION

A. Just prior to completion of project, strip protective coatings of covering from aluminum and clean all parts. Repair to new condition to replace any materials damaged during installation.

B. Extreme care shall be taken to prevent damage or scratching. Damaged or scratched components will not be accepted and will need to be replaced prior to installation. All workmanship must be top quality with neat miters and fitted joints.

END OF SECTION

Surcana
Food Service Design L.L.C.

SECTION 11 40 00 – FOODSERVICE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. All drawings, general, special and/or supplementary conditions, Division 01, specifications, and related documents apply to the work specified in this section.

1.2 SUMMARY OF THE WORK

A. Project and Location-The project is:
Cypress Fairbanks CyFalls HS School Renovation
Houston , Texas

B. Acceptance of the Working Surface: Contractor executing work over the work of another contractor shall notify the Architect of any unacceptable conditions. If no notification is made, then beginning any work constitutes contractor's acceptance of the prior work.

C. Field Verification of Dimensions: Prior to procuring materials or executing any work, contractors must site verify all dimensions of the building and are responsible for the accuracy of them. Add-ons or supplements will not be accepted for discrepancies in drawings and in existing conditions or for work executed under this contract. If discrepancies are found, contractor is required to submit them to the Architect or Surcana FSD for directions prior to proceeding.

D. Cutting and Patching: Excessive cutting is not allowed. Contractor is not permitted to cut ANY structural members without the written approval of the Architect. Contractor shall leave all chases and openings straight, true and of appropriate size as may be required for the installation of his as well as other contractors' work. After his work has been installed, he shall neatly fit around, close, repair, patch and point up to the satisfaction of the Architect.

E. Coordination: The GC, contractors and subcontractors shall coordinate their work with all Adjoining work and fully cooperate with all trades to further the overall advancement of the work. Each trade to provide all other trades with reasonable time for completion of their work and the storage of their materials.

F. Observation and Inspection: The Architect, Owner, Surcana FSD and/or their designee are to have acceptable and safe access to the site no matter the stage of the project to observe and/or inspect what they deem necessary.

G. Permits and Inspections: Procure and coordinate ALL permits, licenses and inspections that are necessitated by the work following all laws, codes, regulations, and contract requirements.

1.3 SCOPE

A. Scope to encompass the work specified, indicated, and deduced as part of Foodservice Equipment. If required, because of regional trade agreements and or restrictions, some parts of this work can be subcontracted to qualified contractors.

B. General Contractor is responsible for Related Work specified in other Sections.

C. Work consists of providing ALL necessary services, tools, equipment, material, and labor required for the installation as designated on the food service equipment plan and in specifications including but not limited to uncrating, erecting, setting in place, leveled, trimmed, caulked, anchored, sealed, and made ready for final connection by the appropriate Division contractors. If specifications and drawings differ in any manner or ANY discrepancies are found, bidders must seek clarification from Architect and or Surcana FSD prior to bid. Contractor is responsible for providing equipment and the Work so that equipment is fully operational as designed and intended.

1.4 RELATED WORK OF OTHER CONTRACTORS

A. General Construction by Contractor:

1. All floor assemblies including finishes, openings, depressions, sleeves, curbs, and bases.
2. All wall and/or partition assemblies including finishes, openings, recesses, sleeves, furring and backing.
3. All ceiling assemblies including finishes, openings, soffits, access panels, fire separation and sleeves.
4. All roof assemblies including finishes, openings, curbs, platforms, and dunnage.
5. All structural supports or grounds for hanging or fastening of food service equipment assemblies as may be described in this section.

B. Plumbing by Contractor:

1. Water, gas, and steam supply systems, as required.
2. Sanitary and grease laden drainage systems.
3. Final plumbing connections including mounting of drains, faucets, pre-rinses, hoses and from point of connection on equipment to building plumbing systems and interconnections between equipment components. Install all hoses from utility raceways to connection points on equipment.

C. Grease traps as required.

D. Indirect drain line runs from equipment items to nearest floor drain or floor sink as required.

E. Gas, water, and steam pressure reducing valves and all other fittings as required.

F. Gas shut off valve(s) as required for vent hood fire suppression system and gas regulators on Individual pieces of gas fired equipment in accordance with the manufacturer's recommendations are to be provided by the Kitchen Equipment Contractor and installed by the Contractor.

G. Kitchen equipment contractor to furnish faucets with nipples, elbows, supply lines and valve stops, drains and/or splash mounted vacuum breakers, etc. for each equipment item as specified. Items to be installed by the Contractor.

H. Indirect wastes shall be chrome plated and are to drip over and into floor drains. Where drains and/or supply lines run under equipment provide the proper support from the underside of the equipment to eliminate interference with cleaning and/or maintenance.

I. H.V.A.C.

1. Contractor to provide and install all necessary components as may be required for the exhaust/make- up air system(s) and condensate exhaust air system including but not limited to the fans (unless provided by the Kitchen Equipment Contractor), ducting, gas shut-off valve(s), curbs, penetrations, dampers, controls and/or switches unless otherwise specified herein.
2. Contractor to provide and install as required rated chase(s) as well as other separations as may be required.

J. Contractor to provide and install all heating, ventilating, and air conditioning systems except as otherwise specified in this section.

K. Electrical by Contractor:

1. All electrical distribution, lighting, and power systems except otherwise specified in this section.
2. Final electrical connections and inter-connections including labor and materials from point of connection on equipment to building electrical systems and required interconnections between equipment components.

L. All electrical materials including wire, conduit, over current protection, main switches, safety cut-outs, shunt-trip breakers, disconnect switches, lightning control devices, surge protectors, uninterruptible power units and controllers.

M. Shunt-trip breakers and/or contactors and all conduits for shut down of electrically operated cooking equipment and/or ventilation equipment as required for vent hood fire suppression system.

N. Empty conduit systems for refrigeration system, as specified and/or shown on food service drawings.

O. Empty conduit system for point-of-sale system, as specified and /or shown on food service drawings.

P. Empty conduit system for fire suppression system, as specified and/or shown on food service drawings.

Q. Furnish and install switches and/or disconnects within equipment, contactors, combination Starters with fused disconnects, controls and similar items necessary for the safe and proper operation of the equipment and for compliance with all N.E.C.

R. All switches, disconnects, and/or control devices shall be safely accessible.

S. Kitchen Equipment Contractor to secure cords to the underside of the equipment on portable and/or movable equipment as to allow ease of maintenance or as required by the Owner.

T. Install all electrical cord sets provided by the Kitchen Equipment Contractor as part of the foodservice equipment. Install all cord sets from utility raceways to their connection points on the equipment.

1.5 EQUIPMENT FURNISHED / INSTALLED BY OTHERS

A. Acquire physical info and utility requirements of Owner-Furnished/Owner-Installed equipment. Coordinate requirements with the building utilities and rough-in drawings/provisions and incorporate details into submittal drawings. Same for ALL Vendor or Purveyor furnished equipment.

1.6 WORK INSTALLED BUT FURNISHED BY OTHERS

A. Acquire and coordinate utility requirements of Owner Furnished/Contractor Installed equipment with the building utilities and rough-in drawings/provisions. Coordinate the delivery and installation of such equipment no later than 3 months prior to before equipment is required. Treat equipment receiving / installation as if it is being provided under this 11400 section.

1.7 RE-USED EXISTING EQUIPMENT

A. Utility disconnection and re-connection: under Divisions 22 and 26.

B. Disassembly, removal, transportation, and relocation: under this Section and scheduled with General Contractor. Owner's representative must be present, coordinate date / time with owner.

C. Thoroughly clean inside and out prior to relocation.

D. Review functional parts (e.g., doors, controls, heating elements, compressors, etc.) and submit report of required repairs and estimate of cost.

E. Existing equipment not scheduled for reuse is to be carefully removed under this Section, at the Owner's direction.

F. Removal or replacement of existing equipment is to be scheduled for times of least interruption and inconvenience to the foodservice operation. Submit proposed schedule of time frame, task sequence and operation for approval prior to starting work.

1.8 QUALITY ASSURANCE

A. Equipment and installation of the work must comply with ALL applicable laws, statutes, building codes and regulations of public authorities/local jurisdictions. Equipment must meet individual organizational standards below and bear their labels as applicable. Contractor to furnish proof of listings with initial submittal.

1. National Sanitation Foundation (all equipment).
2. National Electrical Code (on applicable equipment).
3. Underwriter's Laboratories (on applicable equipment).
4. American Gas Association (on applicable equipment).
5. National Fire Protection Association (on applicable equipment).
6. American Disabilities Act (all equipment)
7. Department of Energy (on applicable equipment).
8. Environmental Protection Agency (on applicable equipment).

B. If the project is outside of the US, equipment and the work must comply with any and all governing codes and regulations that may be required by the local Authority Having Jurisdiction.

1.9 ALTERNATES/SUBSTITUTIONS & APPROVED EQUALS

A. Specified items and brands are meant to be the Basis of Bid. Any other brands, including those which may be listed as "Alternates" or "Approved Equal," must conform to the specifications, size, accessories, etc. of the primary brand. Contractor to make any adjustments in space, utilities and construction as necessary for the alternate/substitutions to meet the original brand specs as designed at contractors own expense. Equipment in similar group or category to be same manufacturer brand.

B. Proposed Substitutions:

1. Submit no later than 10 business days before bid date.
2. Submit proposed substitutions with spec sheet and manufacturers drawings detailing any modifications necessary to conform with specified brand.

C. Substitutions with prior approval:

1. Submit on separate proposal form with each item's monetary additions or deletions and the required documentations called out in B-02 of 1.9. Provide all services necessary to make adjustments in space, systems, utilities etc. and all costs associated that will be incurred by acceptance of said substitution ALL at contractor's expense.
2. Owner reserves the right to accept or reject any or all substitution proposals before execution of Contract.

1.10 INTERPRETATION OF DOCUMENTS

A. Specifications and drawings have been prepared to form the basis for procurement, erection, start-up, and adjustment of all equipment in this contract. Plans and specifications are to be considered in conjunction with one another. When items and/or work are required by one but not by the other, contractor is to provide as though required by both. If specifications and drawings differ in any manner or ANY discrepancies are found, bidders must seek clarification from Architect and or Surcana FSD prior to bid. Contractor is responsible for providing equipment and the work so that equipment is fully operational as designed and intended.

B. If the drawings disagree in themselves, or the specifications with the drawings, the higher cost, better quality, and greater quantity of the work, items and or materials shall be completed without additional costs to the Owner.

C. In the course of bidding, contractors', suppliers' or vendors' questions relating to construction documents will be answered by an addendum.

D. Following Award:

1. Confirmation of Construction Document requirements will be provided by Clarification Bulletin.
2. Request for Information Bulletins submitted by Contractor are to include Contractor's proposed resolution.

1.11 WARRANTY

A. All items on project to have a one-year parts and labor written warranty starting from the date of Substantial Completion. Wearable items such as door gaskets, light bulbs and or component replacements due to improper maintenance or cleaning are excluded.

B. Refrigerated Equipment: Provide three-year parts and labor (excludes walk-in assemblies and systems).

C. Compressors: Provide 5-year parts warranty

D. Provide a list of local factory authorized warranty service agents with the corresponding equipment data for all items on project. Include all contact details required to setup a service call.

1.12 SUBMITTALS

A. General Requirements:

1. Submit shop drawings, samples and brochures simultaneously in one complete submittal.
2. Equipment List: Submit an itemized list of equipment to be furnished under this contract, to include manufacturer's name and model number, along with all necessary and/or required options and/or components, for each piece of equipment necessary.

B. Samples:

1. Provide all samples of materials for test purposes/ comparisons and approval. Samples used for testing shall not be used on the work without the written approval of Surcana FSD / Architect. Submit color/pattern selection samples of ALL solid surface finishes, polymer products, laminates, paint, stain, vinyl surfaces and tile for approval prior to use and or fabrication.
2. Samples may be retained by Surcana FSD, the Project Architect or the Owner as a matter of record without any additional compensation to the Contractors.
3. Owner to provide all samples as required to Kitchen equipment contractor to ensure proper sizing of dispensing equipment specified and or warewash and holding equipment as applicable (cups, glasses, pans, trays, dishware, etc.).

C. Brochures:

1. Provide two (2) hard copied complete brochures for review showing each piece of standard manufactured equipment, complete with all details and/or descriptions of the manufacturer's specifications. Contractors will return one (1) brochure (set) with comments noted for further action. Continue submitting until final approval from Surcana FSD is achieved. After approval provide (7) hard copies in a three-ring binder with such details and specifications clearly numbered with the item number as per the food service equipment plans.
2. Hard copy brochures are to be bound in booklet form in three ring binders delivered at the demonstration and start-up to include the following:
   a. A separate data sheet for each component or item of equipment indicating item number, description, quantity, manufacturer, model number, finishes, modifications, options, and utility requirements.
   b. Catalog specification sheet and / or manufacturer's specifications and drawings complete including accessories. Arrange booklets so those items are in numeric order

in accord with the contract documents with each page numbered in relation to that item. Include with each specification sheet and/or drawing a copy of the warranty information, operations manual and service information. Also include a completed contractor's and the food service equipment contractor's guarantee and warranty.

3. Provide (1) complete bound set of operator's manuals and maintenance instructions containing complete description, wiring diagrams, operating data and other information pertaining to the proper operation and up-keep for the specified items of mechanical equipment having motors or other moving parts. After approval provide (3) record copies in a three-ring binder clearly numbered with the item number as per the food service equipment plans. Include names, addresses and telephone numbers of authorized service agencies for all items with mechanical equipment as well as information of local rep.

D. Shop, Rough-in, and/or Mechanical Connection Drawings:

1. Kitchen equipment contractor to provide (1) blueprint and (1) reproducible set of shop drawing prints for review and comments by Surcana FSD. The one (1) reproducible print with comments noted will be returned for correction. Continue resubmitting as noted above until final approval is achieved. Upon final approval submit prints as required per Architect's requirements and one (1) CADD thumb drive of approved prints for distribution.
2. Kitchen equipment contractor to prepare rough-in drawings locating all equipment (new, existing, or as provided by owner) shown on the contract documents. The rough-in requirement drawing included in these documents are provided as an instrument of service and are not to be used for construction and/or reproductions. Provide (7) 1/4" scale drawings on sheets the same size as contract documents showing, with vertical and horizontal dimensions, the required rough ins (including sleeves and conduits) for electric, gas, water, steam, sanitary waste, refrigeration, ventilation, condensation drain lines, air and exhaust connection nd wood backing for wall mounted fixtures and equipment. Show details, sections, and characteristics for slab depressions and/or other features and/or installation including data for all services in each area. Locations of equipment shall allow for traps, switches, and/or other final connection requirements. All drawings shall include floor plans showing equipment as per the contract documents, elevations, details, and sections.
3. Provide complete plans with dimensions showing locations and elevations of all plumbing, electrical and mechanical rough ins each with their own respective sheets. Use same symbols, connection numbers, and dimensioning system as indicated in Contract Documents (scale 1/4"). All engineering requirements are to be updated as required to accommodate the provided equipment and or match the contract documents. Kitchen equipment contractor is responsible for the coordination of any MEP revisions to accommodate the provided and proposed equipment. The kitchen equipment contractor is responsible for any cost associated with equipment substitutions.
4. Provide complete plans and details showing locations and elevations of all depressions, bases, curtain walls and hoods and any critical wall dimensions. Use same dimensioning system as indicated in Contract Documents (scale 1/4").
5. Prior to fabrication, kitchen equipment contractor to submit fabrication shop drawings for approval. Shop drawings showing plan and elevations to be 3/4" scale, sections shall be 1-1/2" scale covering all fabricated items. Drawings to show location of equipment to be coordinated with each item such as boosters mounted below dish table, disposers under sink compartments.
6. Fabrication details must identify all metal gauges, hardware, trim, electrical parts, special fitting and other components by manufacturer's name and model number.

7. Foodservice Submittal Documents are to be signed by the kitchen equipment contractor to

indicate they have been reviewed and coordinated with submittals by electrical, plumbing, mechanical, millwork or other trades and meet all contract requirements. Foodservice Submittal Documents, which are not stamped and approved by the kitchen equipment contractor will be returned to as "NOT REVIEWED". The kitchen equipment contractor will be required to resubmit after review, as stated above.

E. Checking:

1. Checking of rough-in drawings, shop drawing, details, and equipment by Surcana FSD is for design concept only and does not relieve the kitchen equipment contractor or Contractor of responsibility for compliance with design drawings, details and specifications, verification of utilities with equipment requirements for conformity and location and verification of all dimensions of equipment, building conditions or reasonable adjustments due to deviations. Drawings shall be prepared on the Foodservice Equipment Contractor's sheets. Drawings of any part created by photograph, paste-up, or other methods using Surcana FSD and/or Architect's drawing(s) and / or details is a violation and will be returned for re-submittal. Kitchen equipment contractor will assume responsibility for the proper locations and sizing of sleeves, conduits, and depressions for the various equipment requirements. Kitchen equipment contractor is responsible for making multiple field inspections to verify the rough-in locations prior to the pouring of concrete, the closing of walls, etc. Kitchen equipment contractor shall compensate other trades for any relocation of rough-ins.

F. Distribution:

1. All prints are to be delivered in a mailing tube. After checking, supply the specified number of distribution prints for record purposes. All CADD drawings shall be on thumb drive with all drawings formatted as a *.dwg or *.dfx file.

1.13 SERVICE MANUAL

A. Provide (3) complete bound set of operator’s manuals and maintenance instructions containing complete description, wiring diagrams, operating data and other information pertaining to the proper operation and up-keep for the specified items. Number with the item number as per the food service equipment plans and include specification sheet and manufacturers shop drawings. Include names, addresses and telephone numbers of authorized service agencies for all items with mechanical equipment as well as information of local rep. If available, provide video recorded instructions explaining operation and maintenance.

1.14 VERIFICATION AND COORDINATION OF PROJECT / DATA

A. Utilities Rough-in Drawings and field verifications to be completed within four weeks after approval to proceed and prior to concrete pour. Review contract drawings and submittal data for correctness and entirety and advise Architect of conflicts and suggested modifications. Coordinate work with other subcontractors and verify the installed utility proportions and locations are accurate and acceptable.

B. Review critical systems/components for application, performance and capacity and submit calculation worksheets with initial submission of brochure/rough-in drawings, with all proposed adjustments noted, including:

1. Exhaust hood removal/supply air volume, velocity, static pressure, duct collar sizes, locations, exhaust hood fire suppression system and its components locations.

2. Refrigeration Systems capacities/sizes, quantities, and refrigerant piping distances/sizes.
3. Locations of Vacuum Breakers and floor troughs/trench drains.
4. Wastewater conservation measures required by applicable guidelines/codes
5. Gas, water and steam/condensate and chilled water line sizes and manifold configurations.
6. Diameter and length of flexible connector lines for fixed movable gas appliances.
7. Fabricated Equipment load center panels (individual and total amperage calculations and circuit balance).
8. ADA compliance of workstations, service positions, walkways, etc.

C. Ceiling suspended equipment or fixtures: verify and coordinate dimensions/location of support framing/hangers with General Contractor. All material and installation below 12'-0" above finished floor to be a part of Section 114000.

D. Dimensional Liability: acquire accurate measurements for exact fit of equipment. Dimensions Indicated in contract documents are as accurate as can be determined at the time. Field verify all measurements and conditions at the site before fabrication or delivery of equipment. Inform the Architect of any variances from the dimensions shown.

E. All equipment must be fabricated to allow delivery and installation thru finished corridors and openings. Clarify and understand site limitations for handling/moving/installing equipment and components within the building and coordinate with General Contractor.

F. Clarify dimensions and layout of walk-in assemblies and dry storage areas to allow for specified shelving/dunnage sections. Advise Architect of any discrepancies between the contract documents and confirmed conditions.

G. Review mobile equipment required to fit into or thru fixed equipment (dollies, pan racks, dispensers etc.) to ensure compatibility at time of initial shop drawing submittal. Stipulate any conflicts and with proposed solution or modifications.

H. If necessary, relocate work as to coordinate associated items at no charge if no extra work is involved.

PART 2 - PRODUCTS

2.1 MATERIALS / COMPONENTS

A. Stainless steel to be Type 304 with a #4 finish.

1. Stainless steel seams/connections are to be TIG welded. The welds are to be ground smooth without deficiencies and polished to match finish of abutting material.
2. Stainless steel grain direction of horizontal stainless-steel surfaces (including backsplashes) to run “East West “.

B. Sound Deadening-Apply NSF gray latex sound deadener for large brushed/rolled sections and Tacky Tape butyl sealant between tops, channels and between all framing members of all fabricated equipment.

C. Laminates/Solid Surfaces/Tile: color, pattern, style, and thickness selected by Architect.

D. ID plates, labels and tags: All to be made of phenolic material and engraved with item function ect. Secure with stainless screws or plastic cement.

E. Casters

1. Fabricated fixtures with "Open Base" construction: Jarvis and Jarvis Model No. 5-405-113P-NSF swivel casters with grease seals on forks and wheels; Zerk fitting in swivel; two casters: Model No. E-75 Vertilock brakes. All casters: B-7" rolling bumpers with stainless steel top discs.

F. Cutting Boards: ¾" thick Read Products, Inc. cutting board, size as indicated.

2.2 PLUMBING / MECHANICAL REQUIREMENTS

A. Plumbing Fittings and Components- Items provided in this section are:

NOTE: FITTINGS AND COMPONENTS EXPRESSED IN ITEMS 1, 2 AND 3 ARE PROVIDED LOOSE FOR INSTALLATION BY DIVISION 22 AND OR 23

1. Control valves, equipment pressure regulators for gas, steam,water and vacuum breakers as needed on foodservice equipment (provide in chrome-plated when exposed).
2. ALL faucets drains without connected overflows (unless specified differently) ,11400 fill faucets and hose assemblies specified / shown on drawings.
3. Properly sized commercial water hammer arrestors for all foodservice equipment with solenoid-operated water valves.
4. Extensions of indirect waste fittings to open-sight floor sink or floor drains from sinks, under bar equipment, and food holding components of serving counters with drains (food wells, cold pans, frost tops ect that do not have condensate evaporators) provided and installed by Division 22.
5. Drains: paint with aluminum paint when exposed, use type "K" copper when concealed with piping brackets and supports beneath/within fabricated equipment.
6. Closed Base Bodies: removable 18 gauge stainless steel closure panel at plumbing penetrations, under top.
7. Control valves on Open Base fixtures: mounted on 14 gauge stainless steel panel with 3½" setback from counter top edge/rim to face of control handle.
8. Fill hose/faucet at support pedestals or Closed Base Body: installed in a 15" x 18" x 5" deep recessed mounting panel. Panel bottom: sloped on a 60^{o} angle, with 3/8" stainless steel rod hanger-bracket for hose.
9. Water filtration system:
   a. Everpure filters for ALL water connected foodservice equipment sized by manufacturer unless specified otherwise.

B. Gas-Heated Equipment Fittings and Components: provided under this section:

1. Fixed Equipment: Dormont brand KIT2S double swivel with restraining cable gas hose kit sized per equipment requirements. Approved equal: T&S. Gas valve sized per equipment requirement.

C. Final Plumbing Connections Provisions.

1. Fabricated equipment containing components, fittings and/or devices indicated on Foodservice connections drawings to be connected to the building systems: each component, fitting or group thereof pre-piped to a utility compartment for final connection by Division 22. Refer to drawings for capacities.
2. Field-assembled equipment (e.g., prefabricated walk-in refrigerator/freezers, exhaust hoods, warewash machines, convection ovens, etc.): plumbing components completely

interconnected under this Section for final connection arrangements indicated on Utility Connection Drawings.

3. All plumbing final connection points of equipment shall be tagged, indicating:
   a. Item number.
   b. Name of devices or components.
   c. Type of utility (water, gas, steam, drain, chilled water).

D. Ducts and Vents.

1. Exhaust hoods which are furred-in to ceiling: 2” high duct collar for final connection to duct system.
2. Warewash machines equipped with integral vent cowls or extended hoods: furnished with 18 gauge stainless steel seamless duct risers to 6” above finish ceiling for final connection. The duct: trimmed at ceiling with 16 gauge stainless steel angle flange with all corners welded.

2.3 FOODSERVICE EQUIPMENT REFRIGERATION SYSTEMS

A. Installed with all the components and fluids needed for the proper operation of the system.

1. Self-contained and manufacturer installed systems: set to proper operating temperature that is required to meet ALL codes.

B. Walk-In Refrigeration System Components:

1. Unit coolers: specified quantity and model, ceiling hung by 1/2" o.d. nylon bolts with stainless steel washers and nuts. Insert hanger bolts through plastic sleeve and seal penetration airtight.
2. Unit cooler drain fittings: positioned as indicated on drawings. Install cast tee fitting on drain-pan outlet with union, clean out plug and extend 1" copper drain-line through wall panel to air gap fitting or floor drain.
3. Slope drain-line 1/2" per foot, trap at exterior of assembly and turndown into drain. Manifold drain lines of adjacent compartments wherever possible.
4. Install plastic sleeve through compartment wall, seal around drain-line and install stainless steel escutcheon with setscrew.
5. Heat exchanger: on all unit coolers; in proper size.
6. Electric drain-line heater cable: on all unit coolers operating below 36 degrees F, installed from drain-line fitting to wall penetration. Heater cables: minimum rating of 30 watts/ lineal foot, 120 volt. Wrap drain line with maximum of 2" loop spacing and wire to unit cooler for continuous operation.
7. One (1) evap fan door activation switch to shut off evap coils when door is opened.

C. Refrigeration System Installation:

1. Refrigerant lines: Type "L" hard copper tubing. Fittings: wrought copper or brass designed for use with high temperature solder. Piping joints: made with silver solder (Sil-Fos). Piping: properly suspended from and anchored to the structure with adjustable hangers 6' o.c. maximum. Suction lines: sized to have maximum pressure drop of two pounds in medium temperature systems; one pound in low temperature systems. Liquid lines: sized to give maximum pressure to prevent trapping of oil. Rigid insulation: 1" thick Armstrong Accotherm (1-1/2" thick at low-temp) with factory applied fire retardant jacket and vapor barrier on all suction lines.
2. Cover exterior refrigeration lines with aluminum jacketing. Seal any openings where

lines pass thru exterior walls with expanding foam. Paint silver to match aluminum jacketing.

D. Evacuation and Charging:

1. After completion of the pressure test, the system should be evacuated using an a method that meets all codes/requirements. Connections for evacuation to meet manufacturer's recommendations.
2. Charging subsequent to the initial charge, which is contained in the condensing unit: given through the charging valve in the high side passing all the liquid refrigerant through a charging dehydrator. All charging lines and gauges: purged of air prior to connection with system. After the system is fully charged: started and placed in full operation.

E. Refrigerant Leak Detection Systems

1. In the City of Houston and any other jurisdiction with similar requirements, when the quantity of refrigerant in the system dictates the necessity for a refrigerant leak detection system, this system shall become the responsibility of the foodservice contractor.

2.4 PLUMBING TRIM

A. Faucets: furnished for all sinks or equipment requiring open water supply.

B. Fill Faucets: furnished for appliances requiring open water supply. Unless otherwise noted in Part 4 – Equipment Schedule, provide T&S B-0167 faucet assembly complete with flex hose, spray head, valves and ect.

1. Drain Fittings: furnished for all sinks or equipment requiring removal of liquids. Install specified chrome-plated or stainless-steel fittings in die-stamped openings with washers and locknuts. Solder may be used as a sealer but shall not be applied to the top surface of the drain fittings.

2.5 ELECTRICAL REQUIREMENTS

A. All electrical systems, components and accessories within the work of this Section: certified to be in accordance with NEC 70 and ALL National and local codes.

B. Electrical Fittings and Components: provided under this section as follows. Coordinate foodservice equipment loads, voltage and phase with building system and confirm any existing or Owner furnished/Owner Installed equipment requirements.

C. Cord and Caps.

1. Coordinate all Foodservice Equipment cord/caps with related receptacles.
2. All 120 volt “plug-in” equipment shall have Type SO or SJO cord and plug with ground wire fastened to frame/body of item.
3. Cord lengths for fixed equipment: adjusted to eliminate loose-hanging excess.
4. All non-fixed plug-in “buy-out” equipment: Hubbell configuration, ratings as required.
5. All mobile electrical support equipment (heated cabinets, dish carts, etc.) and counter appliances mounted on mobile stands (mixers, food cutters, toasters, coffee makers, microwave ovens, etc.): 8’-0” cord length with cord-hanger strap secured to rear of

equipment or mobile stand.

D. Switches and Controls.

1. Each motor-driven appliance or electrically heated unit: equipped with control switch or starter per Underwriters' Laboratories, Inc. with low-voltage and overload protection.
2. Equipment which is not provided with built-in circuit breakers or fused terminal block and is indicated on Utility Connections Drawings to be directly connected to the building electrical system: a NEMA 4 stainless steel disconnect switch furnished and installed by Division 26.
3. All remote manual starters, disconnect switches, magnetic contactors or starters and push-button stations: NEMA Type 4 enclosure; NEMA Type 1 enclosure only when installed in a Closed Base Body.

E. Heating Elements.

1. Electrically heated equipment: thermostatic controls.
2. Water heating equipment: equipped with positive low-water shut-off.

F. Receptacles and Switches.

1. Receptacles installed in vertical panels of support pedestals or Closed Base Bodies: installed in 12" x 8½" x 3" deep recessed mounting panel sloped on 60^{o} angle and turned up to top of opening.
2. Pre-wire receptacles in closed base fixtures to a junction box installed within 6" from bottom of utility or compressor compartments.
3. Receptacles mounted on Open Base fixtures: installed on 12" x 10½" x 4½" deep 14 gauge stainless steel panel with returned ends and sloping recess. Secure panel to underframe of fixture top.
4. Pre-wire receptacles on open base fixtures to a junction box secured to a leg or mounted on underside of lower shelf. Vertical runs of wiring: made in rigid conduit or within the tubular leg (VERIFY which method prior to construction).
5. Receptacles installed in/on fabricated equipment: Hubbell, Inc. assemblies horizontally mounted in a metal box with stainless steel cover plate.
6. Switches installed in/on fabricated equipment: Hubbell, Inc. with metal box and stainless-steel cover plate. Switches: pre-wired to the controlled device and to a junction box installed within 6" from bottom of utility or compressor compartment. All refrigeration system switches: installed within the compressor compartment near the door opening.
7. Load centers installed in/on fabricated equipment to have all fixture components pre-wired to load center with balanced phase loading. Load center: ready for final connection by Division 26 and flush-mounted within utility compartment rear panel, set back 8" from access door. All breaker/device information typewritten on circuit schedule in load center door (number corresponding breaker/device) with enclosed schematic wiring diagram of fixture components.

G. Light Fixtures.

1. Light fixtures with lamps installed in/on fabricated or field-assembled equipment: pre-wired to a junction box for final connection (continuous-run fixtures when indicated).
2. Display Lights: install LED light fixtures full-length of Display Stand and Serving Shelf with stud bolts and pre-wire through support posts to an apron-mounted switch.
3. Heat Lamps: installed to underside of serving shelf assemblies. When multiple 24" heat lamps are specified, provide maximum length heat lamp chassis. Install all switches

remote from lamps.

4. Walk-In Assembly Light Fixtures: electrically connected through the hub fitting located on the top of the fixture. All horizontal conduit: above ceiling panels. Install plastic sleeve through ceiling panels for electrical conduit. Seal sleeved penetrations airtight at both sides of panel. Lights to be LED style provided by Kitchen Equipment Contractor for installation by electrical contractor.

H. Final Electrical Connection Provisions.

1. Fabricated equipment containing electrically operated components or fittings indicated on Utility Connections Drawings: direct connected, with each component, fitting or group pre-wired to a junction box for final connection by Division 26. Refer to drawings for circuit loading.
2. Fabricated equipment containing electrically operated components and/or devices indicated: circuit-breaker load center with each component or device pre-wired to a separate circuit breaker for balanced phase loading and single final connection by Division 26.
3. Field-assembled equipment (e.g., prefabricated cold storage assemblies, exhaust hoods, warewash machines, etc.) shall have electrical components completely interconnected in this Section for final connection arrangements as indicated on Utility Connections Drawings by Division 26.
4. Pre-wire the following groups of cold storage assembly electrical devices to a top-mounted Junction box for final connection by Division 26 per compartment grouping (unless otherwise indicated).
   a. Light fixtures and switches; heated pressure-relief vent.
   b. Door/jamb heaters.
   c. Evaporator fans, defrost elements and drain line heaters.
5. All electrical final connection points of equipment shall be tagged, indicating:
   a. Item number.
   b. Name of devices on circuit.
   c. Total electrical load.
   d. Voltage and phase.

I. Lamps: in all Foodservice Equipment containing light fixtures. Refrigerator or heated cabinets: To be LED style and shatter proof or enclosed in suitable enclosure to eliminate possibility of broken glass coming into contact with food or surfaces around the food zone.

2.6 CUSTOM - FABRICATED / ASSEMBLED UNITS

A. All pieces fabricated under this section are to be built by the same manufacturer.

B. Mechanical or electrical operating components or products integrated into a fabricated fixture: Provide the specified ventilation and service access required or recommended by the manufacturer. The service access panel(s) size and placement is to permit easy lubrication, adjustment or replacement of all moving parts and is to be indicated on fabrication shop drawings.

2.7 COUNTER / TABLE TOPS

A. 14 gauge stainless steel; all free edges turned down 2" with ¾" tight hem at bottom. Free corners: rounded on ¾" radius.

B. Marine edges: turned up ½" on 45^{o} angle and turned down 2" with ¾" tight hem at bottom.

C. Provide stainless steel insulated raised platform in front of hot wells.

D. Tops abutting high fixtures or walls: cove up specified height and slope back 1½" at top on 45^{o} angle; 2½" slope where piping occurs. Turn down 1" at rear of splash and close ends to bottom of top turn- down. Secure splash turndown to wall with 4" long 14 gauge stainless steel "Z" clip anchored to wall, 36" o.c.

E. Freestanding tables and all serving counter splash-risers: turned back on 90^{o} angle with 1" turndown at rear.

F. Understructure materials/bracing of tops to use a 1½" x 1½" x 1/8" galvanized steel angle welded frame with cross bracing at every 20" spacing maximum. Use 12 gauge stainless steel pads where leg gusset welds to frame and paint frame with rust resistant gray semi-gloss enamel. Secure top to frame with ¼" studs welded every 8" maximum with chrome-plated washer, lockwasher and capnut. Studs: such length that cap nuts can be made-up tight, bringing top down snugly on angle frame eliminating all vibrations or "oil-canning".

G. Tops: 1½" overhang at free sides of underframe or Closed Base Body.

H. Mockett Model No. SG5-26D satin chrome grommet assembly or integrally welded stainless steel flange or inverted gusset where service utilities or support posts penetrate or adjacent to tops, ground and polished to match top.

I. Extend underbracing members to wall, turn down 6" and anchor to wall when specified to be mounted on leg/bracket assembly.

J. All openings in tops: 3/16" high raised die-formed edges.

K. All top openings for pans or inserts: 20 gauge stainless steel, watertight liners, 8½" deep, secured to underside of counter top.

L. All "built-in" and "drop-in" counter equipment/appliances: with framing members at perimeter of opening.

2.8 DRAWERS

A. Liners: Component Hardware # S81-2020-C (20" x 20"), easily removable with drawer in fully extended position.

B. Drawer Frame: 16 gauge stainless steel flanged out at top. Weld the frame to double-paneled 16 gauge
stainless steel drawer front with full-length recessed pull at top with closed ends.

C. Channel-formed horizontal pull: ¾" turndown at front and ends with ½" tight hem. Front edge of pull: flush with face of drawer. Recess behind pull: sloped up on 60^{o} angle, terminating 1" below bottom edge of pull.

D. Mount drawer frame on Component Hardware # S52-2022 slides, with solid nylon rollers, full-depth of fixture. Secure slides to body or brackets to eliminate lateral movement in extended position. Refrigerator drawers: Component Hardware Model No. S52-2024 stainless steel slides.

E. Drawer enclosure in an Open Base Fixture: 18 gauge stainless steel flanged out at top for

attachment to underside of table top. Lower edge of enclosure is flanged in toward open bottom. Mount drawer slides to enclosure and brace as required. Face of enclosure is to be same length and height of drawer face. Provide ¾" deep offset in front of enclosure and 2½" from underside of tabletop for flush-fitting appearance. Drawer enclosure on freestanding fixture: full depth of table framing.

F. Drawer enclosure in a Closed Base Fixture: completely partitioned from adjoining area. Drawer front: flush-fitting with face of body.

G. Cash Drawer: integral stainless-steel body, 3" deep.

2.9 HOT WELLS

A. If well model and manufacturer are not specified within detail of that item number, use Wells #BMW-206RTDU. Remote mount well controls to single stainless panel to house it and controls for sneeze guard lights and heat. Provide detail of construction and mounting location prior to construction or KEC will be responsible for any associated cost to modify to Surcana's approval.

2.10 SINKS

A. 14 gauge stainless steel; all interior corners (horizontal/vertical) coved on ¾" radius with 1½" wide double-walled partitions with flat tops between compartments.

B. Continuous exterior panels of multiple-compartment sinks: 14 gauge stainless steel filler panel welded, ground and polished between compartments.

C. Sinks with dimension larger than 20" x 20" (no overflow): score and slope sink bottom ½" to die-stamped opening fitted with Krowne # 22-507 rotary drain with tailpiece. 14 gauge stainless steel bracket: welded to sink bottom for drain stem with 1½" handle clearance.

D. Sinks with overflow: score and slope sink bottom ½" to die-stamped opening fitted with Krowne # 22- 507 rotary drain with connected overflow and tailpiece. 14 gauge stainless steel bracket: welded to sink bottom for drain stem with 1½" handle clearance.

E. Where sinks are installed in fixture with Closed Base Body, provide a Krowne # 22-507 rotary drain with connected overflow and tailpiece. (Sinks with dimension larger than 20" x 20" in Closed Base Body will not have overflow fitting.) 14 gauge stainless steel bracket: welded to sink bottom.

F. When single-hole deck-mounted faucets are specified, install overflow fitting into side wall of sink compartment and provide ell-fitting in connecting tubing.

G. Flush Covers when specified: ½" thick Read Products/ Richlite cutting board with all corners and edges eased and two 1" finger holes. Support clips: ¼" stainless steel rod 2" long, formed at 45^{o} with two ¾" leg ends (¼" long threaded ends). Insert rod-clips through tight-clearance holes in sink, seal watertight and secure with stainless steel acorn-nuts or tack-weld at exterior of sink wall. Set support clips ½" below top. Provide 14 gauge stainless steel channel or angle support frame to store covers when not in use. Cover holder: adjacent to sink compartment, below countertop or under drawer assembly.

2.11 TRAYSLIDES

A. Trayslides: Must meet all ADA requirements.

2.12 DISHTABLES

A. Soiled/clean dishtable: 14 gauge stainless steel; free edges coved up 3" with 1½" diameter rolled rim and bullnosed corners.

B. Edge of dishtables next to high fixtures or walls: coved up 10" and sloped back 1½" on 45° angle; 2½" slope where piping occurs. Turn down 1" at rear of splash and secure to wall with 6" long 14 gauge stainless steel "Z" clips anchored to wall, @ 36" o.c.

C. Exposed rear splash: 16 gauge stainless steel finish panel from top of splash to bottom edge of rolled rim with welded vertical joint at end. Secure panel with concealed attachment and install bracing 24" o.c.

D. Cove all interior corners (horizontal/vertical) on ¾" radius and slope tables 1/8" per foot to sinks, scuppers or warewash machines, maintaining level crown/splash.

E. Brace dishtables with 1" x 4" 12 gauge stainless steel channels down centerline of top and between each pair of legs, with closed ends. Bracing: secured to underside of dishtable with ¼" studs welded 6" o.c. maximum, with chrome-plated washer, lockwasher and cap nut. Studs: such length that the cap nuts can be made up tight, bringing the dishtable down on the channel-members, eliminating all vibration and "oil-canning."

F. Integrally-welded stainless steel flange or inverted gusset where service utilities or support posts penetrate or abut tops; ground and polished to match top.

G. Hose Bibb: T&S #B-0674-BSTP; mounted on 12 gauge stainless steel flange or inverted gusset bracket with 3/8" stainless steel rod hose hanger.

2.13 DISH AND TRAY DEPOSIT ASSEMBLY

A. 14 gauge stainless steel deposit shelf to be sized as indicated on drawings. Extend shelf through opening, flush with public side of partition. Turn shelf down 1" at front with ¾" return at bottom. Shelf: 1" square turndown at rear long side, integral with conveyor slider pan, tray accumulator or dishtable. Extend rear/end splash to align with head of deposit station opening. Cookson CD Series roll down door to fit opening. Use fire rated version when required and coordinate installation with splashes, jambs etc. or dishtable when adjacent.

B. 18 gauge stainless steel window frame with perimeter flange channel formed 1" x ¾" at both sides of the wall. Weld all corners of frame and install with concealed attachment. Align one jamb of frame with end of conveyor slider pan or dishtable when adjacent.

C. Cookson CD Series roll down door to fit opening. Use fire rated version when required and coordinate installation with splashes, jambs ect or dishtable when adjacent.

2.14 DOORS

A. 18 gauge x 1" stainless steel double pan-formed welded construction, insulated with 1" thick polyurethane boards. Seal perimeter joint of pans. Offset lower horizontal framing member of Closed Base Body to align flush access door with bottom of Body.

B. Channel-formed full-length horizontal recessed pull: ¾" turndown at front and ends with ½" tight hem. Front edge of pull: flush with face of door. Recess behind pull: sloped up on 60° angle and terminated 1" below bottom edge of pull.

C. Door Hardware:

1. Two Component Hardware # M75-1002 stainless steel hinges (notch door/jamb at hinge location) with CH #35-2000 and SS door lock.

D. Louvered opening: cut-out opening size as indicated, turn in 1" and weld. All corners: ground and polished.

1. Full-height 18 gauge stainless steel louver with 1" vanes at 45°, ½" spacing. Perimeter channel- formed frame: 1½" x 1". 45° x 1" x ½" x opening width plus ½" 18 gauge stainless steel louver.
2. Tack weld tab of louver flange to back panel of door.

E. Sliding Doors: fabricate same as Paragraph "A."

1. Aluminum Sliding Door Track: Component Hardware Model No. B57-0000 Series, length as required, and secure to angle frame at top of underside.
2. Front/rear door sheaves: stainless steel ¾" side mounted door hangers; two (2) required per door.
3. Recessed Vertical Pull at Upper Corner of Door: Component Hardware Model No. P63-1012.
4. By-Passing Door Guides secured to bottom shelf: Component Hardware Model No. B62-1093.
5. Door Stop at bottom edge of door: Component Hardware Model No. B60-1086.

F. Offset lower horizontal framing member of Closed Base Body/utility compressor compartment to align door flush with bottom of Body.

2.15 CLOSED BASE BODIES

A. Frame Construction to be fully welded 1½" x 1½" x 1/8" galvanized steel angle with cross bracing and 16ga stainless steel panels. Provide layout of frame detail to Surcana FSD for approval prior to construction.

B. Vertical and horizontal channel members at shelf interior or drawer enclosures, such as corners and center mullions: closed and sealed.

C. Closed Base Bodies set on finished masonry platforms: closed and caulked at underside of equipment overhang and bolted to platform. Body overhang of platform: 1" at free ends 2" at front and exposed rear sides.

D. Closed Base Bodies not set on platform to receive Kason# 1752 6" legs spaced at 4'-0" maximum intervals.

2.16 COMPRESSOR COMPARTMENTS

A. Same material as Closed Base Bodies with back and end partitions; omit bottoms only.
B. 10 gauge steel slide out support: channel frame on full extension slides with 125 lb. minimum capacity secured to fixture frame with anti-vibration mountings for maximum sound deadening. Closed Base Body on solid platform: front-to-back slide out support channels set 4" above bottom for air circulation.

C. Access Door: 18 gauge stainless steel double-pan type with channel formed horizontal recessed pull full length of top (similar profile as Garcy Model No. R-1060) with closed ends. Channel-formed horizontal pull: ¾" turndown at front and face of door. Recess behind pull slopes up on 60^{O} angle, terminating 1" below bottom edge of pull. Offset lower horizontal framing member of Closed Base Body to align flush access door with bottom of body. Door hardware: two Component Hardware Model No. M75-1002 stainless steel hinges (notch door/jamb at hinge locations) and Component Hardware Model No. 35-2000 concealed magnetic catch.

D. Louvered Access Doors: design to be submitted via drawing for approval prior to construction.

2.17 UTILITY COMPARTMENTS

A. Closed Base Bodies or Pedestal Supports: fitted with utility compartments wherever piping or wiring is required in/on the fixture.

B. Same material as Closed Base Bodies with full-height back and end partitions. Omit bottoms except at hose-reel locations.

C. Access Doors: 18 gauge stainless steel double-pan type with channel formed horizontal recessed pull full-length of top with closed ends. Channel-formed horizontal pull: ¾" turn down at front of door, recess behind pull slopes up on 60^{O} angle, terminating 1" below bottom edge of pull. Offset the lower horizontal framing member of the Closed Base Fixture to permit flush alignment of door with face and bottom edge of body. Door hardware: two Component Hardware Model No. M75-1002 stainless steel hinges (notch door/jamb at hinge locations) and one Component Hardware Model No. 35-2000 concealed magnetic catch.

D. No shelves of Closed Base Fixtures are to be penetrated.

2.18 POT RACK

A. Pot Rack to be fully welded stainless steel 2"x ¼" flat bar with #4 finish shaped as drawn. 1 5/8" stainless post risers as drawn and installed at 7'6" above finished floor with Component Hardware # J77-4401 hooks every 6".

2.19 CASHIER / SERVING COUNTERS

A. Exterior Body Panels when specified: ¾" thick marine grade hardwood plywood with plastic laminate or solid polymer in Architect's selection of color/pattern at all exposed surfaces; backing sheet where concealed.

B. Position, size and finish horizontal or vertical reveal as directed by Architect.

C. Secure panels to counter body framing in concealed manner. Install removable panels with "Z" clips overlapping body framing members.

D. Hinged doors in exterior body panel(s): Grass Model No. 1200VZ or 1200VZ8 self-closing hinges. Three required per door; Grass Model No. G/HRZ base plate at each hinge; Ives Model No. TM820 concealed push latch at each door. Confirm Model No. and provide samples with submittal.

2.20 OPEN BASE STRUCTURES

A. 1-5/8" o.d. x 16 gauge seamless stainless steel tubing legs beveled at bottom. 1¼" o.d. crossrails fully-welded (360^{O} smooth and polished) to legs at 10" aff, o.c.

B. Top of Leg: inserted in Component Hardware Model No. A20-0206 gusset fully welded to table frame or sink bottom.

C. Bullet Foot: Component Hardware Model No. A10-0851-C

D. Table Bases: maximum leg spacing of 6'-0" o.c.; dishtable and utensil wash counter bases at 5'-0" o.c.

2.21 UNDERSHELVES

A. Open Base Structures: 16 gauge stainless steel turned down 1½" with tight hem at bottom. Notch all corners to fit tubular legs and weld from underside to completely fill gap, grind and polish. Cove up 2" at rear or ends adjacent to wall, columns, refrigerators, etc. The turn up at freestanding fixtures is to be hemmed tight to bottom of turndown. Brace undershelf with 1" x 4" 14 gauge stainless steel channel at longitudinal centerline and at each intermediate pair of legs.

B. Closed Base Fixtures: 16 gauge stainless steel turned down 1½" at front. Front edge of bottom shelf: turned back and sealed to finished masonry platform or boxed for leg application. Center shelf has ¾" tight hem.

1. Shelves: turn up square at ends (coved up at rear only) to the shelf above or countertop flanged out for attachment with no open spaces at interior.
2. All shelf partitions at exposed ends of cabinet bodies or interiors: free of exposed framing members.
3. Reinforce shelves with full-length 1" x 4" x 14 gauge stainless steel closed hat channel.
4. Unless otherwise noted, all closed base undershelves are to be 22" deep, clear.
5. Fully weld smooth and polish, the vertical seam of shelf turndown/turn up with face of body partition.
6. Seal the vertical seam of square turn-in at exposed interior of open shelf sections.

2.22 ANCHOR PLATES / WOOD GROUNDS

A. Behind finish surface wherever building wall, partitions or ceiling construction will not accommodate direct attachment of equipment such as overshelves, wall cabinets, hose reels, utensil racks, exhaust hoods, display cases, etc. Material and installation by General Contractor. Location and coordination with trades by Section 11 40 00.

B. Anchor Plates: not less than 12" x 12" x ¼" thick steel, secured to the structure above or behind the finished surface, positioned at attachment points.

C. Wood Grounds: length required by fixture, component or device, 24" wide x ¾" thick plywood secured to partition system prior to gypsum board installation.

D. Above ceiling supports structural shapes (4" x 8.0 lb. channel) suspended from structure. Maximum height 15'-0" aff. size: width of equipment x length of equipment plus 6'-0". Crossbracing at 6'-0" on center maximum.

2.23 OVERSHELVES

A. 16 gauge stainless steel with free edges turned down 1" with ½" tight hem at bottom. ¾" radius at free corners.

B. Turn up 2" at walls or abutting pieces with horizontal coved corner at rear. Round front corners of turn up on ¾" radius.

C. Where shelf width exceeds 12" width, reinforce with ½" x 4" 14 gauge stainless steel closed hat channel full-length of shelf.

D. Wall-Mounted Shelves: 16 gauge stainless steel brackets 48" o.c. maximum, set in 6" from ends.

E. Freestanding Shelves: where splash is required at free overshelves, turn up square 2" at ends, cove up at rear and hem tight to lower edge of front turndown. Weld exposed corners.

1. Freestanding overshelves: 16 gauge stainless steel cantilevered brackets at rear of table; double-cantilevered brackets at center of table. Posts for cantilevered overshelves are 1-5/8" o.d. x 16 gauge stainless steel secured to underframe, 4'-0" o.c. Ends of shelves: secured to adjacent wall/fixture or mounted on 1¼" diameter stainless steel posts.
2. Freestanding overshelves not on cantilevered brackets: 1¼" o.d. x 16 gauge stainless steel posts, each pair at 4'-0" o.c., maximum.

F. Glass/Cup Rack Overshelf at Dishtables: 14 gauge stainless steel with 1½" deep "V" trough at free long sides with 1" tight hem at inside of trough. Provide a ½" marine edge at free ends 4" splash at wall. Suspend shelf at 18" above dishtable surface on posts/brackets anchored to dishtable frame/wall at rear; 1" o.d. stainless steel tubing supports from structure above ceiling at front edge, 60" o.c./each end.

1. Install at both ends, ½" stainless steel drain-tube (connecting both V-troughs) extended to dishtable surface through splash turnback.
2. Rack-rest: horizontal full-length 1-5/8" o.d. stainless steel tubing supported at 10" o.c. above shelf (8" o.c. for double service shelf) by 1¼" o.d. stainless steel tubing with closed ends. Support tubing: welded, ground and polished, spaced 60" o.c.
3. Rack-rest supports to wall: 4" x 4" x 10 gauge stainless steel flange plates welded to support tubing. Anchor flanged plates to blocking ground with non-corrosive bolts.

2.24 WALL PANELS

A. Wall Panels: 18 gauge stainless steel, double pan-formed ½" thick with internal stiffener members. Fill with USDA approved thermal insulation, full height and width of panels, attach to interior with mastic. Maximum allowable temperature at rear side of panel: 120^{o}F.

1. Height of panels as required: top of tile base to underside of hood, top of tile base to top cap of stub wall or top of splash to underside of hood.
2. Level and square lower edge and sides.
3. Butt joint all panels.

2.25 HIGHLIGHTING

A. Polish the following vertical surfaces to a No. 8 finish:

1. Stainless steel table and counter top turndowns and backsplash returns.
2. Dishtable and utensil wash counter rolled rims (full radius).
3. Overshelf turndowns.
4. Door and drawer horizontal pulls.
5. Conveyor and dish/tray deposit station turndowns/frame.

2.26 SHOP / FIELD JOINTS

A. Field joints: least possible number, used only when equipment size must be limited for access into building or interior space.

B. Stainless steel tops (including edges and splashes): fully welded, ground and polished to match adjacent surface.

C. Vertical field joints of fixture backsplashes that are inaccessible from the back: terminate 1" above the horizontal coved corner. The remaining height of field joint: hairline butt joint with offset draw-angle behind. All horizontal/vertical draw-joints: located and noted on shop drawings. Hairline butt joint: 1½" x 1½" x 1/8" steel angles welded to back/underside of countertop/shelf. Offset angle beyond joining metal edge ½" (min.) to provide flat backing surface for joint with angle of other joining metal edge, set for ½" space between vertical legs of angles. Bolt sections together with 5/16" machine bolts, lock washers, acorn head cap nuts, set 3" o.c.

D. Closed Base Bodies: draw-type with hairline seam fully field-welded.

E. Millwork: plastic laminated material joints shall be doweled, glued and draw-bolted with fasteners.

F. Solid Polymer: surfaces drawn tight, filled, sanded and finished to match adjacent surface.

G. Hairline butt joint: 1 ½" X 1 ½" X 1/8" steel angles welded to back/underside of countertop/shelf. Offset angle beyond beyond joining metal edge, set for ½" space between vertical legs of angles. Bolt sections together with 5/16" machine bolts, lock washers, acorn head cap nuts, set 3" on center.

2.27 DRAIN TROUGHS

A. Liners: 14 gauge stainless steel in sizes as indicated. Interior of liners to be 6" deep with all interior corners (horizontal/vertical) coved on ¾" radius; sloped and scored 1" to integrally welded Component Hardware Model No. D34-Y011 basket drain assemblies @ 48" o.c., fitted with 6" long welded tailpiece. Stainless steel safety chain connected to basket strainer assembly and top of liner wall.

B. Liners: 1" wide perimeter shoulder at the top, turned up flush with finished floor, tight-hemmed back down to the shoulder level and flanged out 2" for attachment to the slab.

C. Underside of sloping portion of liner: 2" long "Z" clips.

D. Grating: Removable (without tools) stainless steel 1 ½" x 3/16" bars spaced every 7/16" with cross bar spacing at 4" on center and full perimeter frame.

2.28 VENTILATION/EXHAUST HOOD

A. Hoods: size/shape as indicated on drawings. All hoods to be built and installed to meet ALL local and national codes. KEC to provide air balance report if/when required to meet ANY local, national requirements / codes or by the Local Authority Having Jurisdiction. Division 22 to install condensate drains as required from hood drain to floor sink. Paint drain line in silver color where exposed.

B. Hang with ½" steel hanger rods provided by the kitchen equipment contractor but anchored to building structure by GC. Hang rods at maximum of 4' spacing. Kitchen equipment contractor to hang and fully trim out hood with stainless trim/closure panels sized to cover from top of hood to a minimum of 6" above finished ceiling.

2.29 EXHAUST HOOD FIRE EXTINGUISHING SYSTEM (FUSIBLE-LINK / LIQUID CHEMICAL)

A. System: installed in accordance with manufacturer's recommendations and applicable codes or standards. Submit Installation certification Form to Architect.

B. Automatic Chemical System: in each filtered exhaust hood/duct assembly and also surface Protection to above/in all equipment required by NFPA Bulletin No. 96 and local Fire Marshall's regulations. Refer to Contract Drawings for quantity of exhaust fan units serving single or multiple exhaust hoods and coordinate with hood/fan controls.

C. Install chemical cylinders as indicated on drawings and install piping to exhaust hoods in totally concealed manner. Set cylinders and cabinets at underside of finished ceiling unless noted otherwise. Exposed piping/fittings within cylinder location and exhaust hood: chrome-plated or sleeved with stainless steel tubing. Exposed pipe threads in/above food zone not acceptable. Submit schematic diagram of installation and confirm critical distances from cylinders to nozzles.

D. System Components: Ansul R-102 system assemblies, in system increments required by dimensions and configuration of equipment and hoods.

E. Remote Manual Release: located in path of egress from protected exhaust hood area. Division 26 to provide 4" Octagon box in wall (at 48" aff) with EMT conduit stub to 6" above finished ceiling.

1. Each System: Ansul Automan cylinder control assembly with electric switch.
2. Fusible links installed in duct collar of filtered hoods/ducts.

F. Fusible links located directly above each cooking device required by Code, in quantity required by length of protected appliance.

G. Ansul K-Guard series fire extinguisher located at each exhaust hood. Install at 36" aff to bottom Of extinguisher.

H. Required quantity and sizes of mechanically operated gas valves.

2.30 PREFABRICATED COLD STORAGE ASSEMBLIES

A. Sectional Assemblies: size/shape indicated on drawings; 8'-6" aff unless otherwise specified. Door locations/size: exactly as shown.

B. Panel Insulation to be Foamed In Place urethane. Panels to meet ALL City of Houston requirements including listings, monitoring systems, leak detectors when required and flame spread. Panels must be NSF listed.

C. Wherever compartment dimension exceeds clear-span ability of ceiling panels, provide I-beam support on exterior of ceiling or spline-hangers. Install ½" diameter steel rods through beam/hangers and secure to structure above. Beams or posts within compartments are not acceptable.

D. Reinforce prefabricated wall panels to rigid support the door assemblies. All door jambs: Furnished with replaceable full-perimeter thermostatically controlled heater cable. Install 2" x 4" 16 gauge stainless steel hat-channel full-width of jamb with 1/8" stainless steel removable flush sill, secured with stainless steel screws and sealed watertight to channel.

E. Floorless Assemblies:

01. 6 mil polyethylene sheets in slab recess with all joints lapped 6 inches and sealed to form a watertight seal.
02. Level and square prefabricated perimeter and partition wall panels, anchored to slab recess. Protect exposed surface of panels.
03. Two layers of 2" thick rigid polyurethane board insulation with staggered joints, set in mastic.
04. 15# felt slip sheet over insulation with 6" lapped joints flashed up the height of finished floor base.
05. Concrete flooring and tile over insulation by Divisions 03/09.

F. Intelligent controller with temperature monitor/alarm with sensor and probe-cord length required to extend from exterior front of assembly to a mounting position of the sensor within evaporators return airstream and Panic-alarm Switch installed in each compartment at 72 aff. Interconnect Hubbell Presswitch to EJS Monitor.

G. Provide cove base at interior and exterior of panels that matches panel finish that it is being installed up to.

H. Kason 1809 LED fixtures, one (1) per 64 square feet of assembly.

I. Light Fixtures: wired to interior and exterior companion 3-way Hubbell Presswitch per compartment, mounted in "FS" boxes with Hypalon covers and pilot lights. Compartments with multiple entrances: 4-way switches.

J. Penetrations of Panels: sealed with silicone foam, full depth of panel. Trim excess flush.

K. 12" x 2" engraved phenolic-plastic compartment identification sign in Architect's selection of color with 1" letters, mounted below respective alarm and thermometer.

L. Install closure panels and/or trim strips to building walls and ceiling with concealed attachment. Closure material: same as wall panels unless noted otherwise.

M. Compartment Entrance Doors: 36" x 78" nominal clearance unless otherwise noted.

01. Mount hinged doors on three polished chrome plated or stainless-steel cam-lift hinges.
02. Swing doors as indicated on drawings.
03. Defrost heater: thermostatically controlled and replaceable at full perimeter of all doors, except when using clear Lexan doors (in addition to door jambs). Defrost heaters to be wired for continuous service.
04. 42" high x door length 16 gauge stainless steel kick plates at front and rear of all hinged doors.
05. 12" x 2" engraved phenolic plastic compartment identification sign in Architect's color selection with 1" letters, mounted above door window.
06. 14" x 24" glass view window with heater and molded non-metallic inner and outer frame. Heater to be wired for continuous service.
07. Padlock/key provisions in door latch with interior safety release.
08. Heated pressure relief ports in freezers to be wired for continuous service.

N. Provide refrigeration calculations and refrigeration alarm to meet local City Health Code if required.

O. Assembly to be installed with no gaps and considered "airtight". Vertical panels to have no more than 1/16" plumb variance on inside or outside. Condensation leaking in between and around panels is not acceptable.

2.31 COLD STORAGE REFRIGERATION SYSTEMS

A. Unit Coolers: specified quantity and model, ceiling-hung by ½" o.d. nylon bolts with stainless steel washers and nuts. Insert hanger bolts through plastic sleeve and seal penetration airtight.

01. Unit cooler drain fittings: positioned as indicated on drawings. Installation of cast tee-fittings on drainpan outlet with union and cleanout plug and extension of 1" Type K copper drain line through wall panel to airgap fitting or floor drain under this Section.
02. Slope drain line ½" per foot, trap at exterior of assembly and turn down into drain. Manifold drain lines of adjacent compartments wherever possible.
03. Install drain line plastic sleeve through compartment wall, seal around drain line and Install stainless steel escutcheon with setscrews.
04. Electric drain line heater cable on all unit coolers operating below 36^{O}F., installed from coil drain line fitting to wall penetration under this Section. Heater cables: minimum rating of 15 watts/lineal foot, 208 volts, single phase. Wrap drain line with maximum 2" loop spacing and interwire to unit cooler for continuous operation.
05. Mounted, pre-piped and pre-wired evaporator components:
    a. Sporlan thermostatic expansion valve with external equalizer.
    b. Shut-off valve at evaporator suction and liquid lines.
    c. Sporlan "Catch-All" refrigerant filter/dehydrator on liquid line.
    d. Adjustable thermostat with remote bulb positioned in return airstream of evaporator.
    e. Electrical disconnect switch in NEMA 4 enclosure.

B. Refrigerant System Installation.

01. Refrigerant Lines; Type "L" hard copper tubing. Fittings: wrought copper or brass designed for use with high temperature solder. Piping joints: made with silver solder (Sil-Fos). Piping: properly suspended from and anchored to the structure with adjustable hangers 6' o.c. maximum. Suction lines: sized to have maximum pressure drop of two

pounds in medium temperature systems; one pound in low temperature system. Liquid lines: sized to give maximum pressure to prevent trapping of oil. Insulation on all suction lines: Insulation ¾" thick at medium temp 1" thick at low-temp. Refrigerant lines in PVC or EMT conduit: sealed at both ends with silicone RTV foam. Exterior Refrigerant Lines to be wrapped by refrigeration system installer in self fastening jacket of Type 3003-H14 aluminum alloy 0.016-inch thick. Provide aluminum strapping and seals for applying aluminum jacket and covers according to manufacturer's recommendations to provide completely weather-tight covering.

C. Evacuation and Charging.

01. After completion of the pressure test, the system shall be evacuated using an approved auxiliary vacuum pump. Connections for evacuation: in accordance with manufacturer's recommendations.
02. Charging subsequent to the initial charge which is contained in the condensing unit (Refrigerant type to meet all current national and local codes and be the most efficient option available by said manufacturer): given through the charging valve in the high side passing all the liquid refrigerant through a charging dehydrator. All charging lines and gauges: purged of air prior to connection with system. Refrigerant: unused and shall be delivered in clean containers. After the system is fully charged: start and place in full operation.

PART 3 - EXECUTION

3.1 DELIVERY AND INSTALLATION

A. Supervision: provide a competent foreman or supervisor who shall remain on the job during the entire installation.

B. Delivery: coordinate with progress of construction and Owner's operation schedules. Unless otherwise instructed and documented by Owner or General Contractor, the following procedures apply:

1. Field-Assembled Fixed Equipment integrated into the structure (e.g., cold storage assemblies, exhaust hoods, drain trench/grate assemblies, conveyor systems, ceiling-mounted utensil racks, etc.) are to be sent to the jobsite when directed by the General Contractor and installed/protected accordingly.
2. All other Fixed Equipment: delivered after completion of work on adjacent finished ceilings, lighting, finished floor and wall systems, including painting.
3. Major Movable Equipment: delivered when possible to inventory in secured area for interim jobsite storage or, if secured area is not available, when fixed equipment installation/clean-up has been completed.
4. Minor appliances and loose items (e.g., pans, covers, flatware containers, etc.) delivered only when Owner is prepared to receive and inventory such items.

C. Installation: performed by manufacturer of custom fabricated fixtures.

1. Assemble, square, level and make ready all items for the final utility connections.
2. Cut neatly around obstructions to provide sanitary conditions.
3. Where gaps of ¼" or less occur adjacent to or between equipment, insert rope backing and smoothly applied construction sealant silicone mastic (white color). Mask both sides of gap for neat application of sealant and remove excess. If space exceeds ¼", neatly install 18 gauge stainless steel trim molding of proper shape with concealed attachment. Use

epoxy cement or "Z" clips wherever possible to secure stainless steel trim. Exposed edges or corners of trim: eased and smooth.

4. Refrigeration coil drain line runs to indirect drain connection greater than 2" from face of wall or panel: either of the following field procedures.
   a. Trench the floor and provide 6" wide x 2" deep 16 gauge stainless steel sloping (-1" to -2") trough from face of cooler/freezer wall to body of floor sink/floor drain. Trough: turned up 4" at wall; ¾" flange with ½" turndown at both long sides. Set trough in waterproof mastic and seal 1" o.d. drain tube penetration into floor sink/floor drain at -2½" bff. Patch the floor to match adjacent material/surface.
   b. Provide 12" x 6" x 2" deep 16 gauge stainless steel condensate pan mounted to cooler/freezer
   wall at 6" aff clear. Trench the floor and install 1" o.d. drain line from bottom of pan to body of floor sink/drain. Slope drain line ¼" per foot and seal all connections watertight. Patch the floor to match adjacent material/surface.

D. Protection of Work:

1. Fabricated fixtures: fiberboard or plywood taped to tops and exposed body panels/components.
2. Manufactured Equipment: fiberboard or plywood taped as required by equipment shape and installation-access requirements.
3. Prohibited use of equipment: tool and materials storage, workbench, scaffold, stacking area, etc.
4. Damaged Equipment: immediately documented and submitted to Owner with Contractor's recommendation of action for repair or replacement and its impact on the Project Schedule and Contract Amount, if any.

3.2 CLEAN AND ADJUST

A. Clean up and remove from the job site, all debris resulting from this Work as the installation progresses.

B. Thoroughly clean and polish interior/exterior of all Foodservice Equipment, prior to demonstration and final observation, ready for Owner's use.

C. Lubricate and adjust drawer slides, hinges, casters.

D. Adjust pressure regulating valves, timed-delay relays, thermostatic controls, temperature sensors, exhaust hood grilles, etc.

E. Clean or replace faucet aerators, line strainers.
F. Touch-up damage to painted finishes.

G. Start up and check operation of all refrigeration systems for at least 72 hours prior to acceptance.

3.3 EQUIPMENT START-UP/DEMONSTRATION

A. Final inspection will be made when the contractor will certify that he has completed his work; made a thorough review of the installation/operation of each item in the contract and found it to be in compliance with the construction documents.

B. Provide the Owner or Foodservice Operators with a thorough operational demonstration of all

equipment and furnish instructions for general and specific care and maintenance. Coordinate and schedule selected items of equipment and attendees with Owner at least two weeks in advance of demonstration periods.

3.4 FINAL OBSERVATION

A. Final observation will be made when the Contractor will certify that he has completed his work, made a thorough review of the installation/operation of each item in the contract and found it to be in compliance with the Construction Documents.

B. Repetitive final observations (more than two) and all costs associated there to which may be incurred due to the Contractor's failure to comply with the requirements of this Article will be invoiced to this Contractor on a time and expense basis.

PART 4 - EQUIPMENT SCHEDULE

4.1 REGULARLY MANUFACTURED EQUIPMENT/COMPONENTS:

A. Standard finishes and accessories unless specifically deleted or superseded by the Contract Documents.

B. AutoQuotes short form spec that is listed below in equipment schedule for some items are for reference example only and not to be used as base for bid. Kitchen Equipment Contractor is responsible for verifying correct quantities, finishes, brands and options by following the 11400 Spec, drawings and specific notes as well as sections 1.1 thru 4.4 of the front end of this contract document.

4.2 FABRICATED AND FIELD-ASSEMBLED EQUIPMENT:

A. Arrangement and configuration as shown on Plans, Elevations and Detail Drawings.

4.3 REFER TO DRAWINGS:

A. For unit quantities and electrical or mechanical provisions required, including manufacturer’s optional voltages, wattages, burner capacities, etc.

4.4 REFER TO PART 2 – PRODUCTS:

A. For accessories, fittings, requirements and procedures related to the listed buy-out and fabricated equipment.

4.5 FOODSERVICE EQUIPMENT:

ITEM NO. 1 WALK-IN REFRIGERATION SYSTEM QUANTITY 1

Manufacturer: Refrigeration Design Technologies
Model: ZS Series
Size and Shape: Refer to drawings
Utilities: Refer to drawings
Alternate: Coldzone

01. Cooler to be sized for +35 degrees.
02. Freezer to be sized for -10 degrees.
03. Unit mounted on 36"H galvanized angle iron frame to be anchored to concrete pad.
04. S/S housing and skirting around frame.
05. All exposed piping to be insulated and aluminum wrapped.
06. NEMA 4XS/S disconnect provided and installed by Electrical Contractor.
07. Provide 5 year compressor warranty & 1 year full labor warranty
07. System must meet all Cy-Fair ISD district's standards
    - Locate coil switch on the front of the coil.
    - Electrical controls to be dust proof
    - Provide headmaster controls.
    - Liquid line to be parallel to suction line but separated.
    - Liquid line to covered by aluminum jacket but outside of the insulation.
    - System must have outlet to interconnect to the owner's backup generator.
    - Do not install an evaporator door switch

Specific Notes:

Refer to drawings for specific location to mount remote system. Installation of refrigeration lines and conduit must be coordinated with appropriate trades and GC to seal any building penetrations from installation of lines. Insulate and heat all drain lines. Must coordinate site meeting with Vernon Cyfair ISD Facilities Foreman prior to installation.

ITEM NO. 9 WALK-IN ASSEMBLY QUANTITY 1

Manufacturer: American Panel
Model: ---
Size and Shape: Refer to drawings
Utilities: None
Alternate: Thermokool

01. Foamed in place urethane panels 4" thick
02. 4" FIP factory floor both compartments to be recessed in 8 ½" pit.
03. Exposed exterior to be S/S smooth finish with aluminum stucco finish unexposed
04. Interior ceiling and wall panels to be smooth white aluminum finish.
05. Three (3) hinges per door with door stop
06. Doors to be S/S smooth finish with 3'H Diamond Tread Kick plate on interior and exterior.
07. Diamond tread plate 3'H AFF along all exposed exterior walls (NO TILE BASE).
08. One (1) Kason 1809 LED fixture for every 64sqft of compartment.
09. Heated viewport 14"X24" on all doors with flush style thresholds.
10. All penetrations for plumbing and electrical to be thru wall NOT thru ceiling.

11. Provide 20ga S/S closure panels above walk-in to extend above finished ceiling.
12. Provide 20ga S/S trim to any abutting walls.
13. Clear Vu bi-parting strip door per each walk-in door
14. In-Wall backing in door panel for strip door mounting.
15. LED temp display with alarm, panic button and 4.5" SS dial thermometer per door.
16. Edwards 340A-N5-120VAC alarm bell
17. Provide & install 6"H SS cove base at all interior walls (NO QUARRY TILE).
18. (1) Door Stop for Cooler door and (1) Door Stop for freezer door.
19. Provide chase/conduit inside panel wall for running building alarm wire to Controller.

Specific Notes:

Evaporators to be mounted 18" from panel wall and temp sensors adjacent to them and NOT behind. Install P trap coming out of evaporator. Electrical for lights to be ran perpendicular to evaporators. Must coordinate site meeting with Cyfair ISD Facilities Foreman prior to installation. Installation must meet CyFair ISD standards

ITEM NO. 12 WALK-IN SHELVING QUANTITY 2

Manufacturer: Metro
Model: MetroMax 'Q'
Size and Shape: Refer to drawings
Utilities: None
Alternate: Cambro Elements

01. Each shelving unit to have four (4) tiers with four (4) post and removable vented mats.
02. Provide four (4) 74" posts per unit.
03. Verify sizes, widths and lengths per drawings.
04. Quantity of two (2) to equal two (2) Lot consisting of all shelving shown in the walk-in assembly.

Specific Notes:

Field verify sizes and quantities. Provide shelving layout submittal to be approved prior to ordering.

ITEM NO. 13 DUNNAGE RACK QUANTITY 12

Manufacturer: Metro
Model: Bowtie Series
Size and Shape: Refer to drawings
Utilities: None
Alternate: Cambro

01. All polymer slotted dunnage sized per drawing.
02. 1500 lbs minimum weight capacity.
03. Include two (2) bowtie connectors per rack.

Specific Notes:

Field verify sizes and quantities. Provide layout submittal to be approved prior to ordering.

ITEM NO. 14 MILK DOLLY QUANTITY 4

Manufacturer: Grainger
Model: AFT-30-NM
Size and Shape: Refer to drawings
Utilities: None

01. Platform truck with aluminum deck
02. 400pd capacity

ITEM NO. 15 AIR SCREEN QUANTITY 1

Manufacturer: Mars
Model: STD-2 Series
Size and Shape: Refer to drawings
Utilities: Refer to drawings
Alternate: Berner

01. STD-2 Series unheated air door sized to fit kitchen receiving door.
02. Plunger type remote mounted door switch.
03. Verify all mounting clearances to door before installing.
04. Verify finish/color with owner prior to ordering.

Specific Notes:

Electrical contractor to provide and install flex conduit to j-box of air curtain and neatly secure it to the building. Provide door switch to G.C. for installation by electrical contractor.

ITEM NO. 16 DRY STORAGE SHELVING QUANTITY 1

Manufacturer: Metro
Model: MetroMax Q
Size and Shape: Refer to drawings
Utilities: None
Alternate: Cambro Elements

01. Each shelving unit to have five (5) tiers with four (4) post and removable vented mats.
02. Provide four (4) 86" posts per unit.
03. Verify sizes, widths and lengths per drawings.
04. Quantity of one (1) to equal one (1) Lot consisting of all shelving shown in the dry storage area.
05. When floor drain is placed underneath a shelving unit, delete the bottom shelf and provide and install a 3-sided snake frame.

Specific Notes:

Field verify sizes and quantities. Provide shelving layout submittal to be approved prior to ordering.

ITEM NO. 17 CAN RACK QUANTITY 2

Manufacturer: New Age
Model: 1250CK
Size and Shape: Refer to drawings
Utilities: None
Alternate: SPG

01. Rack to hold (162) #10 cans or (216) #5 cans
02. Provide 6" casters, (2) with brakes

ITEM NO. 18 WASHER QUANTITY 1

Manufacturer: BY OWNER
Model: ---
Size and Shape: Refer to drawings
Utilities: Refer to drawings

ITEM NO. 19 DRYER QUANTITY 1

Manufacturer: BY OWNER
Model: ---
Size and Shape: Refer to drawings
Utilities: Refer to drawings

ITEM NO. 21 CHEMICAL SHELVING QUANTITY 1

Manufacturer: Metro
Model: MetroMax
Size and Shape: Refer to drawings
Utilities: Refer to drawings
Alternate: Cambro Premium

01. Each shelving unit to have five (5) tiers with four (4) post and removable solid mats.
02. Provide four (4) 86" posts per unit.
03. Verify sizes, widths and lengths per drawings.
04. When shelving is placed over janitor sink, provide Metro Smartwall w/Metroseal finish three (3) tier wall mount shelving or equivalent.
05. Verify mounting height and spacing prior to installation.

Specific Notes:

Field verify sizes and quantities

ITEM NO. 22 JANITOR SINK QUANTITY 1

Manufacturer: BY PLUMBER
Model: ----
Size and Shape: Refer to drawings
Utilities: Refer to drawings

ITEM NO. 23 MOP / BROOM HOLDER QUANTITY 4

Manufacturer: U-Line
Model: H-2841
Size and Shape: Refer to drawings
Utilities: Refer to drawings

01. Mop Hanger, 24" stainless steel
02. Butt end to end and secure to wall

ITEM NO. 24 HAND SINK QUANTITY 10

Manufacturer: BY PLUMBER
Model: ----
Size and Shape: Refer to drawings
Utilities: Refer to drawings

ITEM NO. 25 MOBILE TRANSPORT CART QUANTITY 8

Manufacturer: Cres Cor
Model: 150051
Size and Shape: Refer to drawings
Utilities: none
Alternate: New Age

01. Units to be modified to meet CFISD requirements.
02. Provide five (5) years parts warranty.

ITEM NO. 26 CORNER GUARDS QUANTITY 1 LOT

Manufacturer: Custom Fabricated
Model: ---
Size and Shape: Refer to drawings
Utilities: none

01. 304 series 16ga S/S corner guards 3”X 3” with #4 finish located on all outside corners inside kitchen. Full height from coved base to ceiling. Radius to match wall profile.
02. One (1) to equal One (1) Lot

ITEM NO. 27 WALL BUMPERS QUANTITY 1 LOT

Manufacturer: Pawling Corporation Architectural
Model: MD-1
Size and Shape: Refer to drawings
Utilities: none

01. Install bumper rails at 35” A.F.F.
02. Provide end caps and outside corners as required.
03. Bumper rails to be color black.
04. Quantity One (1) to equal One (1) Lot: provide on all exposed walls throughout kitchen, including exposed walls of the walk-in assembly.

ITEM NO. 31 SELF CONTAINED WALK-IN ASSEMBLY QUANTITY 3

Manufacturer:	Portabull
Model:	8’ x 20’ x 9’6”H Outdoor Self Contained WI
Size and Shape:	Refer to drawings
Utilities:	208V 3phase (Step Up Transformer to be used)
Alternate:	Conexwest or Equal

01. Units to be delivered by manufacturer and arrive fully assembled. Units to be ready for Outdoor operation only requiring power to the units electrical disconnect
02. Units to have an exterior ramp for smooth transition into WI Assembly.
03. Units to be delivered to site, unloaded and set in place where located on drawings
04. Units to be picked up from site and returned after usage is completed.
05. Units to be self contained with refrigeration package capable of Low (-10 degrees) and or Medium temps (34 degrees)
06. Single Butcher Entry door to be large enough to accommodate pallet jack & assembly floors to be smooth flat or Diamond tread plated and rated for pallet jack traffic. Units to have manufactured supplied interior lighting.
07. KEC to remove Owners Existing shelving and dunnage and erect inside the temporary WI Assemblies.
08. Each WI Assembly to have a temperature alarm with remote monitoring capability, safety/panic alarms, dry contacts and a data line connection that meets CyFair ISD’s requirements. Units must be connected to owners alarms.
09. Manufacturer to provide 24/7 service and warranty products during entire rental period

Specific Notes:

Units to be Rented/Leased during construction renovations and then returned. If manufactures Remote Temp/Alarm monitoring system does not meet CyFair ISD requirements, contractor to provide third party system and temporarily install during rental/lease duration.

ITEM NO. 100 ICE MACHINE W/BIN QUANTITY 1

Manufacturer:	Manitowoc
Model:	IDT-0450A/D-570
Size and Shape:	Refer to drawing
Utilities:	Refer to drawing
Alternate:	Hoshizaki

01. One (1) filtration system with one (1) pre-filter
02. One (1) ice maker model no. IDT-0450A.
03. One (1) ice bin model no. D-570.
04. Stainless steel legs with flange feet
05. LuminIce II Factory Install
06. K00463 Ice Scoop
07. Minimum water supply line feed to be 3/8”

Specific Notes:

Filtration system to be easily accessible for service and mounted to abutting wall. Supply line to filtration system to be plumbed in copper. Supply line from filter to ice maker to be a flexible line that provides enough length to pull ice maker away from wall 48” without disconnecting. Final connections to be made by plumbing contractor. Attach water filter overflow tube to rear of ice maker/bin and route to floor sink.

Exhaust fan to be installed in ceiling above the ice machine by GC. The use of ground fault circuit interrupters is not recommended for use on Hoshizaki equipment. Product should be installed on independent circuit with properly sized HACR-rated breaker. If local code requires the use of GFCI, the preferred method of protection is a GFCI HACR-rated breaker and not an outlet-type GFCI.

ITEM NO. 107 DISPOSER QUANTITY 4

Manufacturer: Master Disposer
Model: C-3-L
Size and Shape: Refer to drawings
Utilities: Refer to drawings
Alternate: Red Goat

01. Disposer C Series 3HP
02. 208v/60hz/3ph
03. Model C-BC18 Bowl Cone Assembly
04. Model RAC2-KP RAC2 Disposer Control Panel
05. Two (2) Model 10-5-701 Water Swirl Inlet Valves per disposer
06. Install disposer into table as shown on drawings.

ITEM NO. 113 MOBILE WORKTABLE QUANTITY 4

Manufacturer: Custom Fabricated
Model: ---
Size and Shape: Refer to drawings
Utilities: Refer to drawings

01. 304 series S/S 14ga top and 16ga undershelves as drawn with edges turned down 2”
02. Provide and install one (1) S/S drawer assembly with S/S pan insert, slides and lock per table
03. Set of four (4) 5” S/S bodied casters with polyurethane treads two (2) swivel and two (2) Swivel with brake
04. Recess 24”X 24½”D Richlite cutting boards into table tops

Specific Notes:

Match height of abutting tables to height of bottom conveyor

ITEM NO. 116 UTILITY CART QUANTITY 8

Manufacturer: Lakeside
Model: 544
Size and Shape: Refer to drawings
Utilities: None
Alternate: Piper Industries

01. Stainless Steel 3 shelf cart
02. Four (4) casters two (2) with brakes and perimeter bumpers

ITEM NO. 126 PAN RACK QUANTITY 8

Manufacturer: Cres Cor
Model: 207-UA-12AD
Size and Shape: Refer to drawings
Utilities: None
Alternate: New Age, Lakeside

01. Aluminum welded construction.
02. 1405-000 Perimeter bumper and enclosed base
03. Twelve (12) adjustable universal angles.
04. 5" Polyurethane Casters

ITEM NO. 127 THREE COMP PREP SINK W/DISPOSER QUANTITY 2

Manufacturer: Custom Fabricated
Model: ---
Size and Shape: Refer to drawings
Utilities: Refer to drawings

01. 304 series S/S 14ga top with ½" Marine edge and 16ga undershelves as drawn.
02. Edges to be turned down 2" at free sides with 10"H splash at abutting walls.
03. Omit rear rail at sink bowls and at disposer when shown.
04. Two (2) T&S model # B-0291, splash mount faucet, 18" swing nozzle
05. Three (3) Krowne 22-507 twist waste valve drains
06. Provide One (1) T&S model #B-0133-cr-b08sk pre-rinse
07. Provide S/S 16ga welded bracket to secure drain handles and S/S 14ga mounting plate for disposer control.
08. Three (3) 24"x26"x15" D 14ga sink bowls
09. S/S 1 5/8" Upright post to extend thru backsplash with a 12" D 16ga perforated overshelf mounted at 18" above work surface. Post to continue vertically then turn out 12" D at 7' AFF. Weld 2" x ¼" S/S flat bar across post and provide Advance Tabco model TA-86 S/S double sided pot hooks every 6".
10. Install disposer and control panel as drawn with fully welded sink cone.
11. Three (3) "Richlite" ½" thick removable sink covers with 1" finger hole left and right installed at each sink. Weld S/S ¼" round bar set 1/2" below work surface at all four corners to support sink covers. Provide S/S channel support storage holder for sink covers at right or left end of counter.
12. Provide raised platform as drawn and mount one (1) Edlund model no. S-11.
13. Provide S/S adjustable flanged feet for front legs and S/S adjustable bullet feet for all others. Anchor flanged feet to floor after leveling.
14. Provide T&S model B-0674-BSTP and rack mount on S/S 12ga bracket.

Specific Notes:

When disposer is shown, provide notch in backsplash to accommodate vacuum breaker.
When overshelf is shown above disposer with pre-rinse, provide cutout in shelf to accommodate pre-rinse.

ITEM NO. 129 MOBILE ISLAND WORKTABLE QUANTITY 17

Manufacturer: Custom Fabricated
Model: ---
Size and Shape: Refer to drawings
Utilities: None

01. 304 series S/S 14ga top and 16ga under shelves as drawn.
02. Edges to be turned down 2" at all sides.
03. Provide and install two (2) S/S drawer assemblies per table with S/S pan insert, slides and lock.
04. Set of four (4) 5" S/S bodied casters with polyurethane treads two (2) swivel and two (2) swivel with brake

ITEM NO. 131 PAN RACK (PIZZA) QUANTITY 4

Manufacturer: New Age
Model: 1461PB
Size and Shape: Refer to drawings
Utilities: None
Alternate: Channel MFG

01. Extruded aluminum fully welded construction
02. Perimeter bumper. Guides welded horizontally and vertically
03. Must hold (38) 18"x26" sheet pans at 1.5" spacing
04. 5" Polyurethane Casters. Lifetime Guarantee against rust and corrosion

Specific Notes:

Must be fully welded and ship fully assembled. Knock down construction is not acceptable

ITEM NO. 132 TILT TRUCK QUANTITY 1

Manufacturer: Rubbermaid
Model: FG131400BLA
Size and Shape: Refer to drawings
Utilities: None
Alternate: Tough Guy

01. Seamless one piece body tilt truck with 850pd 1 cubic yard capacity
02. 12" Inset wheels with 5" swivel stem back casters

ITEM NO. 200 FIRE PROTECTION SYSTEM QUANTITY 4

Manufacturer: Ansul
Model: R102
Size and Shape: Refer to drawings
Utilities: Refer to drawings

01. One (1) fire suppression system for each Type 1 exhaust hood.
02. Provide hood and duct protection and surface protection for all cooking appliances.
03. One (1) wall mounted handheld K Guard fire extinguisher
04. Remote fire pulls as shown on plan with pull guards
05. Provide Mechanical gas shutoff valve to be installed by plumbing contractor.

06. System must meet NFPA 96 standards, Fire Marshal's regulations and UL Standard 300
07. Piping to be unexposed in hood with all exposed drops to be chrome plated.
08. Hood penetrations to be trimmed out in S/S.
09. All hoods, switches and pulls to be properly labeled.

Specific Notes:

Mount fire extinguisher 4' below cabinet.

ITEM NO. 201 EXHAUST HOOD QUANTITY 1

Manufacturer: Mod-U-Serve
Model: W-cpb
Size and Shape: Refer to drawings
Utilities: Refer to drawings
Alternate: Accurex

01. All 304 18ga S/S fully welded construction size and shape as drawn.
02. Sloped grease trough with S/S filters.
03. Insulated front air supply plenum with adjustable damper in same materials and finish as hood.
04. LED fixtures with lights to be flush mounted.
05. 18ga S/S closure panels to enclose space from top of hood to finished ceiling and S/S finished back panel when exposed.
06. Suspend hood and components at 6' 10" AFF using ½" threaded rod by KEC.
07. Factory mounted 3" Back Airspace.
08. Provide air balance report as required by Code and or by Local Authority Having Jurisdiction.
09. Exhaust equipment to maintain 18" clearance from combustibles. For clearances less than 18", provide 3" air space with code approved fire barrier/wrap designed and installed to meet ALL local codes and requirements.

Specific Notes:

Hood and components to meet all NSF standards, NFPA 96, UL 710 and current IECC requirements. If hood is installed against a wall made of combustible material, provide 18ga S/S insulated wall panel from bottom of the hood to baseboard/cove base. Electrical contractor to connect light switch to hood as designed and install shunt trip breakers for ALL equipment under hood as required.

ITEM NO. 202 EXHAUST HOOD QUANTITY 1

Manufacturer: Mod-U-Serve
Model: W-cpb
Size and Shape: Refer to drawings
Utilities: Refer to drawings
Alternate: Accurex

01. All 304 18ga S/S fully welded construction size and shape as drawn.
02. Sloped grease trough with S/S filters.

03. Insulated front air supply plenum with adjustable damper in same materials and finish as hood.
04. LED fixtures with lights to be flush mounted.
05. 18ga S/S closure panels to enclose space from top of hood to finished ceiling and S/S finished back panel when exposed.
06. Suspend hood and components at 6' 10" AFF using ½" threaded rod by KEC.
07. Factory mounted 3" Back Airspace.
08. Provide air balance report as required by Code and or by Local Authority Having Jurisdiction.
09. Exhaust equipment to maintain 18" clearance from combustibles. For clearances less than 18", provide 3" air space with code approved fire barrier/wrap designed and installed to meet ALL local codes and requirements.

Specific Notes:

Hood and components to meet all NSF standards, NFPA 96, UL 710 and current IECC requirements. If hood is installed against a wall made of combustible material, provide 18ga S/S insulated wall panel from bottom of the hood to baseboard/cove base. Electrical contractor to connect light switch to hood as designed and install shunt trip breakers for ALL equipment under hood as required.

ITEM NO. 203 EXHAUST HOOD QUANTITY 1

Manufacturer: Mod-U-Serve
Model: W-cpb
Size and Shape: Refer to drawings
Utilities: Refer to drawings
Alternate: Accurex

01. All 304 18ga S/S fully welded construction size and shape as drawn.
02. Sloped grease trough with S/S filters.
03. Insulated front air supply plenum with adjustable damper in same materials and finish as hood.
04. LED fixtures with lights to be flush mounted.
05. 18ga S/S closure panels to enclose space from top of hood to finished ceiling and S/S finished back panel when exposed.
06. Suspend hood and components at 6' 10" AFF using ½" threaded rod by KEC.
07. Factory mounted 3" Back Airspace.
08. Provide air balance report as required by Code and or by Local Authority Having Jurisdiction.
09. Exhaust equipment to maintain 18" clearance from combustibles. For clearances less than 18", provide 3" air space with code approved fire barrier/wrap designed and installed to meet ALL local codes and requirements.

Specific Notes:

Hood and components to meet all NSF standards, NFPA 96, UL 710 and current IECC requirements. If hood is installed against a wall made of combustible material, provide 18ga S/S insulated wall panel from bottom of the hood to baseboard/cove base. Electrical contractor to connect light switch to hood as designed and install shunt trip breakers for ALL equipment under hood as required.

ITEM NO. 204 EXHAUST HOOD QUANTITY 1

Manufacturer: Mod-U-Serve
Model: W-cpb
Size and Shape: Refer to drawings
Utilities: Refer to drawings
Alternate: Accurex

01. All 304 18ga S/S fully welded construction size and shape as drawn.
02. Sloped grease trough with S/S filters.
03. Insulated front air supply plenum with adjustable damper in same materials and finish as hood.
04. LED fixtures with lights to be flush mounted.
05. 18ga S/S closure panels to enclose space from top of hood to finished ceiling and S/S finished back panel when exposed.
06. Suspend hood and components at 6' 10" AFF using ½" threaded rod by KEC.
07. Factory mounted 3" Back Airspace.
08. Provide air balance report as required by Code and or by Local Authority Having Jurisdiction.
09. Exhaust equipment to maintain 18" clearance from combustibles. For clearances less than 18", provide 3" air space with code approved fire barrier/wrap designed and installed to meet ALL local codes and requirements.

Specific Notes:

Hood and components to meet all NSF standards, NFPA 96, UL 710 and current IECC requirements. If hood is installed against a wall made of combustible material, provide 18ga S/S insulated wall panel from bottom of the hood to baseboard/cove base. Electrical contractor to connect light switch to hood as designed and install shunt trip breakers for ALL equipment under hood as required.

ITEM NO. 207 CONVECTION OVEN DOUBLE QUANTITY 8

Manufacturer: Vulcan
Model: VC44GD
Size and Shape: Refer to drawings
Utilities: Refer to drawings.
Alternate: Blodgett

01. Solid state controls with 60-minute timer (Dial style temp and timer control)
02. Simultaneous doors both with glass.
03. 1/2 HP 2-speed motor per deck with cool down switch
04. Set of four casters, front swivel with brakes & two rear rigid
05. Five (5) oven racks per compartment
06. Provide S/S backs when exposed.
07. One (1) T&S HG-4D-60SK per oven compartment for independent gas connections

Specific Notes:

Convection ovens to be connected to owners backup generator.

ITEM NO. 211 STEAMER DOUBLE QUANTITY 3

Manufacturer: Accutemp
Model: N6120E DBL
Size and Shape: Refer to drawings
Utilities: Refer to drawings

01. Six (6) pan capacity per compartment
02. Two (2) individual steam generators and compartments.
03. Field reversible insulated doors.
04. SNH-21-01 - Support Stand
05. One (1) 3M SF165 Filtration System per unit.
06. Two (2) T&S HG-4C-60SK quick gas disconnect kits with double swivels per unit.

Specific Notes:

Filter to be mounted near unit and be easily accessible for service. Ensure placement of steamer is not over floor drain. Plumbing to filter to be copper with S/S flex lines plumbed to steamers. Flex lines to allow unit to be pulled out 48" without disconnecting.

ITEM NO. 226 TWO BURNER RANGE QUANTITY 1

Manufacturer: Southbend
Model: P32C-XX
Size and Shape: Refer to drawings
Utilities: Refer to drawings
Alternate: Vulcan

01. Two (2) 45K BTU burners
02. Cabinet base with removable doors and intermediate shelf.
03. S/S range body on casters.
04. Rear gas connection.
05. PR24-32 Flue Riser
06. External pressure regulator.
07. Cap and cover front gas manifold.
08. 16" S/S work top per 16" (2) burner section located on right with common front rail and common backguard.
09. MODIFICATION-Modify worktop option to accommodate faucet filler and fill handle with control valve built into front panel.
10. Krowne 20-203L incorporated into 16" work top
11. One (1) T&S HG-4E-60SK per unit
12. Spark ignition with flame failure for all open burner sections.
13. 1" Natural Gas Regulator

ITEM NO. 238 PIZZA OVEN QUANTITY 2

Manufacturer: Lincoln
Model: 1180-2G
Size and Shape: Refer to drawings
Utilities: Refer to drawings
Alternate: Middleby Marshall

01. Double oven on stand with casters
02. Model 1182 Heat Shield
03. Two (2) Model 1140 shelves per oven
04. Reversible conveyor
05. Two (2) T&S HG-4D-60SK per double stack
06. Abutting tables to be height matched to conveyor belts.

Specific Notes:

Conveyor ovens to be connected to owners backup generator.

ITEM NO. 243 RAISED RAIL PIZZA PREP - 2DR QUANTITY 1

Manufacturer: Traulsen
Model: TS072HT
Size and Shape: Refer to drawings
Utilities: Refer to drawings
Alternate: Delfield

01. S/S exterior and interior including SS back
02. Unit must hold (10) 1/3rd size pans
03. Six (6) years parts and labor and 7-year compressor warranty
04. Full length 18"D Richlite cutting board
05. Stainless steel interior shelving and 6" casters

ITEM NO. 252 TRENCH LINER QUANTITY 1

Manufacturer: Custom
Model: ---
Size and Shape: Refer to drawings
Utilities: Refer to drawings

01. Liner to be 14ga 304 S/S fully welded construction.
02. Provided by KEC and Installed by general contractor.
03. Subway style grating 3/16" X 1" solid Aluminum bar with max 7/16" spacing.
04. S/S strainer basket with handle.
05. Coordinate location of trench liner with General Contractor and match pour path of any equipment when applicable.

ITEM NO. 300 REACH-IN REFRIGERATOR - 1DR QUANTITY 2

Manufacturer: Traulsen
Model: AHT132WUT-HHS
Size and Shape: Refer to drawings
Utilities: Refer to drawings
Alternate: Utility

01. S/S exterior and aluminum interior.
02. LED interior lights
03. Fourteen (14) pair of universal pan slides per full height opening
04. 6" high casters.
05. Six (6) years parts and labor and 7-year compressor warranty

06. Half height doors with locks hinged as shown on drawing.
07. Doors to have field re-hinging option
08. Units to be hardwired and connected to back-up generator.
09. Provide S/S trim around wall openings with removable trim above units.

ITEM NO. 303 PASS-THRU REFRIGERATOR - 1DR QUANTITY 2

Manufacturer: Traulsen
Model: AHT132WPUT-HHS
Size and Shape: Refer to drawings
Utilities: Refer to drawings
Alternate: Utility

01. S/S exterior and aluminum interior.
02. LED interior lights
03. Fourteen (14) pair of universal pan slides per full height opening
04. 6" high casters.
05. Six (6) years parts and labor and 7-year compressor warranty
06. Half height doors with locks hinged as shown on drawing.
07. Doors to have field re-hinging option
08. Units to be hardwired and connected to back-up generator.
09. Provide S/S trim around wall openings with removable trim above units.

ITEM NO. 304 PASS-THRU REFRIGERATOR - 2DR QUANTITY 1

Manufacturer: Traulsen
Model: AHT232WPUT-HHS
Size and Shape: Refer to drawings
Utilities: Refer to drawings
Alternate: Utility

01. S/S exterior and aluminum interior.
02. LED interior lights
03. Fourteen (14) pair of universal pan slides per full height opening
04. 6" high casters.
05. Six (6) years parts and labor and 7-year compressor warranty
06. Half height doors with locks hinged as shown on drawing.
07. Doors to have field re-hinging option
08. Units to be hardwired and connected to back-up generator.
09. Provide S/S trim around wall openings with removable trim above units.

ITEM NO. 306 ROLL-IN REFRIGERATOR - 1DR QUANTITY 2

Manufacturer: Traulsen
Model: ARI132HUT-FHS
Size and Shape: Refer to drawings
Utilities: Refer to drawings
Alternate: Utility

01. S/S exterior and aluminum interior.
02. LED interior lights
03. Six (6) years parts and labor and 7-year compressor warranty

04. Doors to have field re-hinging option
05. Units to be hardwired and connected to back-up generator.
06. Provide stainless steel ramp

ITEM NO. 324 REACH-IN HEATED CABINET - 1DR QUANTITY 1

Manufacturer: Traulsen
Model: AHF132W-HHS
Size and Shape: Refer to drawings
Utilities: Refer to drawings
Alternate: Utility

01. S/S exterior and aluminum interior
02. LED interior lights
03. Fourteen (14) pair of universal pan slides per full height opening
04. 6" high casters.
05. Six (6) years parts and labor
06. Half height doors with locks hinged as shown on drawing.
07. Doors to have field re-hinging option
08. Units to be hardwired and connected to back-up generator.
09. Provide S/S trim around wall openings with removable trim above units.

ITEM NO. 325 REACH-IN HEATED CABINET - 2DR QUANTITY 2

Manufacturer: Traulsen
Model: AHF232W-HHS
Size and Shape: Refer to drawings
Utilities: Refer to drawings
Alternate: Utility

01. S/S exterior and aluminum interior
02. LED interior lights
03. Fourteen (14) pair of universal pan slides per full height opening
04. 6" high casters.
05. Six (6) years parts and labor
06. Half height doors with locks hinged as shown on drawing.
07. Doors to have field re-hinging option
08. Units to be hardwired and connected to back-up generator.
09. Provide S/S trim around wall openings with removable trim above units.

ITEM NO. 328 PASS-THRU HEATED CABINET - 2DR QUANTITY 4

Manufacturer: Traulsen
Model: AHF232WP-HHS
Size and Shape: Refer to drawings
Utilities: Refer to drawings
Alternate: Utility

01. S/S exterior and aluminum interior
02. LED interior lights
03. Fourteen (14) pair of universal pan slides per full height opening
04. 6" high casters.
05. Six (6) years parts and labor

06. Half height doors with locks hinged as shown on drawing.
07. Doors to have field re-hinging option
08. Units to be hardwired and connected to back-up generator.
09. Provide S/S trim around wall openings with removable trim above units.

ITEM NO. 401 SERVING COUNTER QUANTITY 1

Manufacturer: Counter Craft
Model: ---
Size and Shape: Refer to drawings
Utilities: Refer to drawings
Alternate: Mod-U-Serve, Master Fabricators

01. Serving counter to be open base design with storage shelving on operator side. Shelving compartments to have base and intermediate shelves with open back and sides. Intermediate and base shelves to be easily removable without tools for service.
02. Body to be continuous style construction using fully welded 1.5”x1.5”x1/8” galvanized angle iron frame OR fully welded 1 1/4” S/S tubular frame.
03. Top to be 304 series 14ga S/S turned down 2” at all free sides with 16ga S/S shelving.
04. Trayslide to be 14ga S/S with S/S buttons and LED lights below.
05. All S/S edges to have to have #8 mirror finish including countertop, shelves and raised platforms.
06. All electrical wiring to be hidden and secured neatly in base located inside code approved conduit.
07. All plumbing to be hidden in base and neatly secured. Plumbing to be Type L copper with compression style unions.
08. Supply properly sized load center per counter requirements and wire all electrical components to load center with wiring diagram laminated and attached to door.
09. Provide electrical and plumbing access for service.
10. Countertop to be at 34"H with trayslide at 34”H above finished floor.
11. Provide insulated raised platform at hot wells.
12. Provide and install hardibacker to counter body prepped for tile by GC. Do NOT tile Cashier door.
13. S/S legs with adjustable S/S bullet feet and S/S removable kickplates.
14. Provide dedicated 15amp receptacle recessed in counter body for milk box and one (1) convenience outlet in each control panel.
15. Custom control panel to include controls for drop in equipment, lights and heat strips.
16. Five (5) Wells model BMW-206RTDU individual insulated hot wells spaced as drawn with common manifolded drain and ball valve located in an easily accessible location. Hot well area to have 1” recess to accommodate sheet pans and a deck mounted fill faucet.
17. One (1) Wells model RCP7400 cold pan angled a 5-degree slope towards trayslide with remote switch mounted in custom control panel in counter body. Provide perforated false bottom and divider bars for pans. One (1) Hatco FTB-3 sheet pan frost top mounted above cold pan.
18. Provide louvered doors at compressor compartments on operator side with matching louvered cutout on opposite side of counter to allow proper airflow for condensing units.
19. Breath guard undercounter mount single tier with 3/8” glass top shelf, end panels and fully adjustable half height front glass with LED lights. Mount over cold pan

and frost top as drawn. Verify finish with owner.

20. Breath guard undercounter mount single tier with 3/8" glass top shelf, end panels and fully adjustable full height front glass for self or full service with LED lights and heat. Mount over hot wells as drawn. Verify finish with owner.
21. Cashier station with locking cashier drawer, S/S open storage and one (1) NEMA 5-15R. Provide 2" grommeted cutout in top for POS wiring to base.
22. Delivery and installation by manufacturer only with final connections by GC.
23. Angle trayslides in corners to provide smoother transition.
24. Mount ALL condensing units on slide out drawer/track system for service access.
25. One (1) Glastender #DI-FR Ice Cream Freezer angled @ 5 degrees with double tier 16g stainless steel angled chip/snack rack.
26. KEC to provide (3) Bonstone Model No. 52004 Tile Inserts, Color Black.

Specific Notes:

Cash registers must be connected to backup generator through counter outlet. Do NOT tile cashier door. Line Item 26 BonChef Bonstone Tiles required for the first (3) Serving counters only for a grand total of (9) required for this project.

ITEM NO. 402 SERVING COUNTER QUANTITY 1

Manufacturer: Counter Craft
Model: ---
Size and Shape: Refer to drawings
Utilities: Refer to drawings
Alternate: Mod-U-Serve, Master Fabricators

01. Serving counter to be open base design with storage shelving on operator side. Shelving compartments to have base and intermediate shelves with open back and sides. Intermediate and base shelves to be easily removable without tools for service.
02. Body to be continuous style construction using fully welded 1.5"x1.5"x1/8" galvanized angle iron frame OR fully welded 1 1/4" S/S tubular frame.
03. Top to be 304 series 14ga S/S turned down 2" at all free sides with 16ga S/S shelving.
04. Trayslide to be 14ga S/S with S/S buttons and LED lights below.
05. All S/S edges to have to have #8 mirror finish including countertop, shelves and raised platforms.
06. All electrical wiring to be hidden and secured neatly in base located inside code approved conduit.
07. All plumbing to be hidden in base and neatly secured. Plumbing to be Type L copper with compression style unions.
08. Supply properly sized load center per counter requirements and wire all electrical components to load center with wiring diagram laminated and attached to door.
09. Provide electrical and plumbing access for service.
10. Countertop to be at 34"H with trayslide at 34"H above finished floor.
11. Provide insulated raised platform at hot wells.
12. Provide and install hardibacker to counter body prepped for tile by GC. Do NOT tile Cashier door.
13. S/S legs with adjustable S/S bullet feet and S/S removable kickplates.
14. Provide dedicated 15amp receptacle recessed in counter body for milk box and one (1) convenience outlet in each control panel.
15. Custom control panel to include controls for drop in equipment, lights and heat strips.

16. Five (5) Wells model BMW-206RTDU individual insulated hot wells spaced as drawn with common manifolded drain and ball valve located in an easily accessible location. Hot well area to have 1" recess to accommodate sheet pans and a deck mounted fill faucet.
17. One (1) Wells model RCP7400 cold pan angled a 5-degree slope towards trayslide with remote switch mounted in custom control panel in counter body. Provide perforated false bottom and divider bars for pans. One (1) Hatco FTB-3 sheet pan frost top mounted above cold pan.
18. Provide louvered doors at compressor compartments on operator side with matching louvered cutout on opposite side of counter to allow proper airflow for condensing units.
19. Breath guard undercounter mount single tier with 3/8" glass top shelf, end panels and fully adjustable half height front glass with LED lights. Mount over cold pan and frost top as drawn. Verify finish with owner.
20. Breath guard undercounter mount single tier with 3/8" glass top shelf, end panels and fully adjustable full height front glass for self or full service with LED lights and heat. Mount over hot wells as drawn. Verify finish with owner.
21. Cashier station with locking cashier drawer, S/S open storage and one (1) NEMA 5-15R. Provide 2" grommeted cutout in top for POS wiring to base.
22. Delivery and installation by manufacturer only with final connections by GC.
23. Angle trayslides in corners to provide smoother transition.
24. Mount ALL condensing units on slide out drawer/track system for service access.
25. One (1) Glastender #DI-FR Ice Cream Freezer angled @ 5 degrees with double tier 16g stainless steel angled chip/snack rack.
26. KEC to provide (3) Bonstone Model No. 52004 Tile Inserts, Color Black.

Specific Notes:

Cash registers must be connected to backup generator through counter outlet. Do NOT tile cashier door. Line Item 26 BonChef Bonstone Tiles required for the first (3) Serving counters only for a grand total of (9) required for this project.

ITEM NO. 403 SERVING COUNTER QUANTITY 1

Manufacturer: Counter Craft
Model: ---
Size and Shape: Refer to drawings
Utilities: Refer to drawings
Alternate: Mod-U-Serve, Master Fabricators

01. Serving counter to be open base design with storage shelving on operator side. Shelving compartments to have base and intermediate shelves with open back and sides. Intermediate and base shelves to be easily removable without tools for service.
02. Body to be continuous style construction using fully welded 1.5"x1.5"x1/8" galvanized angle iron frame OR fully welded 1 1/4" S/S tubular frame.
03. Top to be 304 series 14ga S/S turned down 2" at all free sides with 16ga S/S shelving.
04. Trayslide to be 14ga S/S with S/S buttons and LED lights below.
05. All S/S edges to have to have #8 mirror finish including countertop, shelves and raised platforms.
06. All electrical wiring to be hidden and secured neatly in base located inside code approved conduit.

07. All plumbing to be hidden in base and neatly secured. Plumbing to be Type L copper with compression style unions.
08. Supply properly sized load center per counter requirements and wire all electrical components to load center with wiring diagram laminated and attached to door.
09. Provide electrical and plumbing access for service.
10. Countertop to be at 34"H with trayslide at 34”H above finished floor.
11. Provide insulated raised platform at hot wells.
12. Provide and install hardibacker to counter body prepped for tile by GC. Do NOT tile Cashier door.
13. S/S legs with adjustable S/S bullet feet and S/S removable kickplates.
14. Provide dedicated 15amp receptacle recessed in counter body for milk box and one (1) convenience outlet in each control panel.
15. Custom control panel to include controls for drop in equipment, lights and heat strips.
16. Five (5) Wells model BMW-206RTDU individual insulated hot wells spaced as drawn with common manifolded drain and ball valve located in an easily accessible location. Hot well area to have 1” recess to accommodate sheet pans and a deck mounted fill faucet.
17. One (1) Wells model RCP7400 cold pan angled a 5-degree slope towards trayslide with remote switch mounted in custom control panel in counter body. Provide perforated false bottom and divider bars for pans. One (1) Hatco FTB-3 sheet pan frost top mounted above cold pan.
18. Provide louvered doors at compressor compartments on operator side with matching louvered cutout on opposite side of counter to allow proper airflow for condensing units.
19. Breath guard undercounter mount single tier with 3/8” glass top shelf, end panels and fully adjustable half height front glass with LED lights. Mount over cold pan and frost top as drawn. Verify finish with owner.
20. Breath guard undercounter mount single tier with 3/8” glass top shelf, end panels and fully adjustable full height front glass for self or full service with LED lights and heat. Mount over hot wells as drawn. Verify finish with owner.
21. Cashier station with locking cashier drawer, S/S open storage and one (1) NEMA 5-15R. Provide 2” grommeted cutout in top for POS wiring to base.
22. Delivery and installation by manufacturer only with final connections by GC.
23. Angle trayslides in corners to provide smoother transition.
24. Mount ALL condensing units on slide out drawer/track system for service access.
25. One (1) Glastender #DI-FR Ice Cream Freezer angled @ 5 degrees with double tier 16g stainless steel angled chip/snack rack.
26. KEC to provide (3) Bonstone Model No. 52004 Tile Inserts, Color Black.

Specific Notes:

Cash registers must be connected to backup generator through counter outlet. Do NOT tile cashier door. Line Item 26 BonChef Bonstone Tiles required for the first (3) Serving counters only for a grand total of (9) required for this project.

ITEM NO. 404 SERVING COUNTER QUANTITY 1

Manufacturer:	Counter Craft
Model:	---
Size and Shape:	Refer to drawings
Utilities:	Refer to drawings
Alternate:	Mod-U-Serve, Master Fabricators

01. Serving counter to be open base design with storage shelving on operator side. Shelving compartments to have base and intermediate shelves with open back and sides. Intermediate and base shelves to be easily removable without tools for service.
02. Body to be continuous style construction using fully welded 1.5”x1.5”x1/8” galvanized angle iron frame OR fully welded 1 1/4” S/S tubular frame.
03. Top to be 304 series 14ga S/S turned down 2” at all free sides with 16ga S/S shelving.
04. Trayslide to be 14ga S/S with S/S buttons and LED lights below.
05. All S/S edges to have to have #8 mirror finish including countertop, shelves and raised platforms.
06. All electrical wiring to be hidden and secured neatly in base located inside code approved conduit.
07. All plumbing to be hidden in base and neatly secured. Plumbing to be Type L copper with compression style unions.
08. Supply properly sized load center per counter requirements and wire all electrical components to load center with wiring diagram laminated and attached to door.
09. Provide electrical and plumbing access for service.
10. Countertop to be at 34"H with trayslide at 34”H above finished floor.
11. Provide insulated raised platform at hot wells.
12. Provide and install hardibacker to counter body prepped for tile by GC. Do NOT tile Cashier door.
13. S/S legs with adjustable S/S bullet feet and S/S removable kickplates.
14. Provide dedicated 15amp receptacle recessed in counter body for milk box and one (1) convenience outlet in each control panel.
15. Custom control panel to include controls for drop in equipment, lights and heat strips.
16. Five (5) Wells model BMW-206RTDU individual insulated hot wells spaced as drawn with common manifolded drain and ball valve located in an easily accessible location. Hot well area to have 1” recess to accommodate sheet pans and a deck mounted fill faucet.
17. One (1) Wells model RCP7400 cold pan angled a 5-degree slope towards trayslide with remote switch mounted in custom control panel in counter body. Provide perforated false bottom and divider bars for pans. One (1) Hatco FTB-3 sheet pan frost top mounted above cold pan.
18. Provide louvered doors at compressor compartments on operator side with matching louvered cutout on opposite side of counter to allow proper airflow for condensing units.
19. Breath guard undercounter mount single tier with 3/8” glass top shelf, end panels and fully adjustable half height front glass with LED lights. Mount over cold pan and frost top as drawn. Verify finish with owner.
20. Breath guard undercounter mount single tier with 3/8” glass top shelf, end panels and fully adjustable full height front glass for self or full service with LED lights and heat. Mount over hot wells as drawn. Verify finish with owner.
21. Cashier station with locking cashier drawer, S/S open storage and one (1) NEMA 5-15R. Provide 2” grommeted cutout in top for POS wiring to base.
22. Delivery and installation by manufacturer only with final connections by GC.
23. Angle trayslides in corners to provide smoother transition.
24. Mount ALL condensing units on slide out drawer/track system for service access.
25. One (1) Glastender #DI-FR Ice Cream Freezer angled @ 5 degrees with double tier 16g stainless steel angled chip/snack rack.

Specific Notes:

Cash registers must be connected to backup generator through counter outlet. Do NOT tile cashier door.

ITEM NO. 405 SERVING COUNTER QUANTITY 1

Manufacturer: Counter Craft
Model: ---
Size and Shape: Refer to drawings
Utilities: Refer to drawings
Alternate: Mod-U-Serve, Master Fabricators

01. Serving counter to be open base design with storage shelving on operator side. Shelving compartments to have base and intermediate shelves with open back and sides. Intermediate and base shelves to be easily removable without tools for service.
02. Body to be continuous style construction using fully welded 1.5”x1.5”x1/8” galvanized angle iron frame OR fully welded 1 1/4” S/S tubular frame.
03. Top to be 304 series 14ga S/S turned down 2” at all free sides with 16ga S/S shelving.
04. Trayslide to be 14ga S/S with S/S buttons and LED lights below.
05. All S/S edges to have to have #8 mirror finish including countertop, shelves and raised platforms.
06. All electrical wiring to be hidden and secured neatly in base located inside code approved conduit.
07. All plumbing to be hidden in base and neatly secured. Plumbing to be Type L copper with compression style unions.
08. Supply properly sized load center per counter requirements and wire all electrical components to load center with wiring diagram laminated and attached to door.
09. Provide electrical and plumbing access for service.
10. Countertop to be at 34"H with trayslide at 34”H above finished floor.
11. Provide insulated raised platform at hot wells.
12. Provide and install hardibacker to counter body prepped for tile by GC. Do NOT tile Cashier door.
13. S/S legs with adjustable S/S bullet feet and S/S removable kickplates.
14. Provide dedicated 15amp receptacle recessed in counter body for milk box and one (1) convenience outlet in each control panel.
15. Custom control panel to include controls for drop in equipment, lights and heat strips.
16. Five (5) Wells model BMW-206RTDU individual insulated hot wells spaced as drawn with common manifolded drain and ball valve located in an easily accessible location. Hot well area to have 1” recess to accommodate sheet pans and a deck mounted fill faucet.
17. One (1) Wells model RCP7400 cold pan angled a 5-degree slope towards trayslide with remote switch mounted in custom control panel in counter body. Provide perforated false bottom and divider bars for pans. One (1) Hatco FTB-3 sheet pan frost top mounted above cold pan.
18. Provide louvered doors at compressor compartments on operator side with matching louvered cutout on opposite side of counter to allow proper airflow for condensing units.
19. Breath guard undercounter mount single tier with 3/8” glass top shelf, end panels and fully adjustable half height front glass with LED lights. Mount over cold pan and frost top as drawn. Verify finish with owner.

20. Breath guard undercounter mount single tier with 3/8" glass top shelf, end panels and fully adjustable full height front glass for self or full service with LED lights and heat. Mount over hot wells as drawn. Verify finish with owner.
21. Cashier station with locking cashier drawer, S/S open storage and one (1) NEMA 5-15R. Provide 2" grommeted cutout in top for POS wiring to base.
22. Delivery and installation by manufacturer only with final connections by GC.
23. Angle trayslides in corners to provide smoother transition.
24. Mount ALL condensing units on slide out drawer/track system for service access.
25. One (1) Glastender #DI-FR Ice Cream Freezer angled @ 5 degrees with double tier 16g stainless steel angled chip/snack rack.

Specific Notes:

Cash registers must be connected to backup generator through counter outlet. Do NOT tile cashier door.

ITEM NO. 406 SERVING COUNTER QUANTITY 1

Manufacturer: Counter Craft
Model: ---
Size and Shape: Refer to drawings
Utilities: Refer to drawings
Alternate: Mod-U-Serve, Master Fabricators

01. Serving counter to be open base design with storage shelving on operator side. Shelving compartments to have base and intermediate shelves with open back and sides. Intermediate and base shelves to be easily removable without tools for service.
02. Body to be continuous style construction using fully welded 1.5"x1.5"x1/8" galvanized angle iron frame OR fully welded 1 1/4" S/S tubular frame.
03. Top to be 304 series 14ga S/S turned down 2" at all free sides with 16ga S/S shelving.
04. Trayslide to be 14ga S/S with S/S buttons and LED lights below.
05. All S/S edges to have to have #8 mirror finish including countertop, shelves and raised platforms.
06. All electrical wiring to be hidden and secured neatly in base located inside code approved conduit.
07. All plumbing to be hidden in base and neatly secured. Plumbing to be Type L copper with compression style unions.
08. Supply properly sized load center per counter requirements and wire all electrical components to load center with wiring diagram laminated and attached to door.
09. Provide electrical and plumbing access for service.
10. Countertop to be at 34"H with trayslide at 34"H above finished floor.
11. Provide insulated raised platform at hot wells.
12. Provide and install hardibacker to counter body prepped for tile by GC. Do NOT tile Cashier door.
13. S/S legs with adjustable S/S bullet feet and S/S removable kickplates.
14. Provide dedicated 15amp receptacle recessed in counter body for milk box and one (1) convenience outlet in each control panel.
15. Custom control panel to include controls for drop in equipment, lights and heat strips.
16. Five (5) Wells model BMW-206RTDU individual insulated hot wells spaced as drawn with common manifolded drain and ball valve located in an easily accessible location. Hot well area to have 1" recess to accommodate sheet pans and a deck

mounted fill faucet.

17. One (1) Wells model RCP7400 cold pan angled a 5-degree slope towards trayslide with remote switch mounted in custom control panel in counter body. Provide perforated false bottom and divider bars for pans. One (1) Hatco FTB-3 sheet pan frost top mounted above cold pan.
18. Provide louvered doors at compressor compartments on operator side with matching louvered cutout on opposite side of counter to allow proper airflow for condensing units.
19. Breath guard undercounter mount single tier with 3/8" glass top shelf, end panels and fully adjustable half height front glass with LED lights. Mount over cold pan and frost top as drawn. Verify finish with owner.
20. Breath guard undercounter mount single tier with 3/8" glass top shelf, end panels and fully adjustable full height front glass for self or full service with LED lights and heat. Mount over hot wells as drawn. Verify finish with owner.
21. Cashier station with locking cashier drawer, S/S open storage and one (1) NEMA 5-15R. Provide 2" grommeted cutout in top for POS wiring to base.
22. Delivery and installation by manufacturer only with final connections by GC.
23. Angle trayslides in corners to provide smoother transition.
24. Mount ALL condensing units on slide out drawer/track system for service access.
25. One (1) Glastender #DI-FR Ice Cream Freezer angled @ 5 degrees with double tier 16g stainless steel angled chip/snack rack.

Specific Notes:

Cash registers must be connected to backup generator through counter outlet. Do NOT tile cashier door.

ITEM NO. 414 MILK COOLER 12 CASE QUANTITY 6

Manufacturer:	Traulsen
Model:	RMC49D6
Size and Shape:	Refer to drawings
Utilities:	Refer to drawings
Alternate:	Beverage Air

01. Forced air milk cooler S/S interior and exterior
02. Holds twelve (12) 13"x13" milk crates with double door access
03. Bumpers/Corner Guards & 6" casters

Specific Notes:

Milk boxes must be connected to backup generator.

ITEM NO. 421 CASH REGISTER QUANTITY 6

Manufacturer:	Owner Furnished
Model:	---
Size and Shape:	Refer to drawings
Utilities:	Refer to drawings

Specific Notes:

Cash registers must be connected to backup generator.

ITEM NO. 422 GUIDE RAILS QUANTITY 1 LOT

Manufacturer: Custom Fabricated
Model: ---
Size and Shape: Refer to drawings
Utilities: Refer to drawings

01. 1-5/8" O.D. S/S round tubing guide rails with 1-5/8" upright post.
02. Uprights to be 4' on center with top rail at 34" above finished floor
03. One lot to equal ALL guide rails shown on drawing

Specific Notes:
Upright post to be sleeved and buried in concrete.

ITEM NO. 501 DISHWASHER LOW TEMP QUANTITY 1

Manufacturer: Hobart
Model: CL44-BAS+BUILDUP
Size and Shape: Refer to drawings
Utilities: Refer to drawings
Alternate: Champion

01. Low Temp single tank conveyor dish machine all S/S construction.
02. Electric tank heat with autofill and self-draining pump.
03. Top mount controls with Vent fan control and Vent Stacks with damper
04. Refer to drawings for direction of conveyor.
05. Single point electrical connection & Higher Than Standard Opening
06. Pressure regulator and table limit switch
07. Two (2) 1/2INSHK-ABSRBR shock absorbers & ½" brass pressure regulator
08. Four peg racks, Four combo racks & Four sheet pan racks

ITEM NO. 507 SOILED DISHTABLE QUANTITY 1

Manufacturer: Custom Fabricated
Model: ---
Size and Shape: Refer to drawings
Utilities: Refer to drawings

01. 304 series S/S 14ga top with 16ga under shelves as drawn.
02. Free edges to be rolled rim style 3 ½" H X 1 ½" with 10"H splash at abutting walls
03. Omit rear rail at sink bowls and at disposer when shown
04. Provide One (1)T&S model #B-0133-cr-b08skpre-rinse
05. One (1) 20" x 20" pre-rinse sink or disposer cone (verify on drawing).
06. Install disposer and control panel as drawn
07. Provide removable 14ga S/S rack guide assembly when sink is shown.
08. Slope tabletop towards dish machine for drainage.
09. Provide S/S 14ga mounting plate for disposer control.

Specific Notes:
When disposer is shown, provide notch in backsplash to accommodate vacuum breaker. When over shelf is shown above disposer with pre-rinse, provide cutout in shelf to accommodate pre-rinse.

ITEM NO. 508 CLEAN DISHTABLE QUANTITY 1

Manufacturer: Custom Fabricated
Model: ---
Size and Shape: Refer to drawings
Utilities: Refer to drawings

01. 304 series S/S 14ga top with 16ga under shelves as drawn.
02. Free edges to be rolled rim style 3 ½" H X 1 ½" with 10"H splash at abutting walls.
03. Omit front rail at booster when shown
04. Provide S/S adjustable flanged feet for front legs and S/S adjustable bullet feet for all others. Anchor flanged feet to floor after leveling
05. Slope tabletop towards dish machine for drainage.

ITEM NO. 510 THREE COMP SINK W/DISPOSER QUANTITY 1

Manufacturer: Custom Fabricated
Model: ---
Size and Shape: Refer to drawings
Utilities: Refer to drawings

01. 304 series S/S 14ga top with 16ga undershelves as drawn.
02. Free edges to be rolled rim style 3 ½" H X 1 ½" with 10"H splash at abutting walls.
03. Omit rear rail at sink bowls and at disposer when shown.
04. Two (2) T&S model # B-0291, splash mount faucet, 18" jointed swing nozzle
05. Three (3) Krowne 22-507 twist waste valve drains
06. Provide One (1) T&S model #B-0133-cr-b08sk pre-rinse
07. Provide S/S 16ga welded bracket to secure drain handles and S/S 14ga mounting plate for disposer control.
08. Two (2) 24"x26"x15" D 14ga sink bowls and one (1) 26"x30"x15" D 14ga sink bowl.
09. S/S 1 5/8" Upright post to extend thru backsplash with a 12" D 16ga perforated overshelf mounted at 18" above work surface. Post to continue vertically then turn out 12" D at 7' AFF. Weld 2" x ¼" S/S flat bar across post and provide Advance Tabco model TA-86 S/S double sided pot hooks every 6".
10. Install disposer and control panel as drawn with fully welded sink cone.
11. Provide S/S adjustable flanged feet for front legs and S/S adjustable bullet feet for all others. Anchor flanged feet to floor after leveling.
12. Provide T&S model B-0674-BSTP and rack mount on S/S 14ga bracket.

Specific Notes:

When disposer is shown, provide notch in backsplash to accommodate vacuum breaker. When overshelf is shown above disposer with pre-rinse, provide cutout in shelf to accommodate pre-rinse. Ensure disposer bracket is recessed enough that control does not protrude past front leg of table.

ITEM NO. 514 MOBILE UTENSIL RACK QUANTITY 8

Manufacturer: Metro
Model: MetroMax PR48VX4
Size and Shape: Refer to drawings
Utilities: None
Alternate: Cambro Premium

01. Four (4) MX74UP per unit
02. Four (4) MX2448G per unit
03. Four Polymer Casters (2) with brake.
04. Two (2) Model XTR2448XEA Pan Drying Rack per unit
05. Two (2) Model XTR2448XE Cutting Board & Tray Drying Rack per unit

ITEM NO. 515 VENT COWL DUCTS QUANTITY 2

Manufacturer: Custom
Model: ---
Size and Shape: Refer to drawings
Utilities: None

01. 16g 304 SS Vent Cowl Ducts sized to fit warewash duct collars
02. Extend 6" past finished ceiling with SS trim ring at ceiling

ITEM NO. 601 ICE BARREL MERCHANDISER QUANTITY 6

Manufacturer: Iowa Rotocast Plastics
Model: 3101502
Size and Shape: Refer to drawings
Utilities: None

01. 70 Quart Ice Barrel Merchandiser with lid and casters
02. Color to be black with no graphics

END OF SECTION 11400

SECTION 11 57 16

PAINT SPRAY BOOTH - FLOOR STYLE

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

1.2 SCOPE

A. Work Included: Include the following addition to items normally part of this Section:
   01 Design, fabrication and installation of paint spray booth.
   02 Design and installation of related ductwork, roof canopies and accessories.

B. Work Specified Elsewhere:
   01 Division 7 - Roofing system.
   02 Division 21 – Fire Suppression
   03 Division 26 - Electrical

C. Reference Standards: Spray booth construction and air flow velocities to conform to OSHA requirements.

1.3 SUBMITTALS

A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.
   04 Indicate finish
   05 Indicate clearances, electrical connections, ducting and roof penetration details.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

E. Maintenance Instructions: Submit manufacturer's complete operation and maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01 Include recommended cleaning products and instructions for use.
   02 Where applicable, provide recommended maintenance schedules and procedures.

F. Operations and Maintenance Manuals:
   01 Provide complete operations and maintenance manuals to the Owner.
   02 Refer to Section 01 78 23 – Operation and Maintenance Manuals.
   03 O & M manuals must be reviewed, accepted and delivered to the Owner prior to Owner demonstration(s).

G. Close-out Submittals:
   01 Updated As-built drawings and shop drawings.
   02 Product and accessory model numbers and contact names/addresses for future re-ordering of parts by Owner.

H. Supplementary Design Details: The general design shown is presumed adequate to permit compliance with the specified performance. Provide details to clarify and supplement the general design.

I. Certification: Submit manufacturer's certificate of compliance with OSHA requirements.

1.4 DELIVERY AND STORAGE

A. Delivery: Deliver clearly labeled, undamaged materials in the manufacturer's unopened containers or wrapping.

B. Timing and Coordination: Deliver materials to allow for minimum storage time at the Project. Coordinate delivery with the scheduled time of installation, storage, and handling.

C. Storage: Store materials in a clean, dry location, protected from abuse.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Approved Manufacturers: Specifications are based on the first named Manufacturer. Other manufacturers must meet or exceed this standard for approval.
   01 RTT Engineered Solutions, Rockwell, TX 75032 (888) 452-6684
   02 Global Finishing Solutions, Osseo, WI 54758 (800) 848-8738
   03 DeVilbiss Ransburg, Toledo, OH 43692 (800) 628-1200
   04 Binks Manufacturing Co., Franklin Park, IL 60131 (708) 671-3000

2.2 MATERIALS

A. Paint Spray Booth:
   01 Basis of Design: RTT Engineered Solutions, model IB-08-08-05-00-S
   02 Size: 8'-4"W x 8'-2"H x 7'-8"L (exterior dimensions)
   03 Cross-draft type, self-supporting unit constructed of 18-gauge galvanized steel with filter intake doors and filtered exhaust plenum back panel.

04 Pre-finished 18-gauge galvanized steel frame and panels with the manufacturer's standard shop paint finish and 'white' strippable interior finish.

05 Exhaust Fan:
- a. CFM: 8,000 SCFM @ ½" SP
- b. Diameter: 24
- c. Horsepower: 3
- d. Voltage: 480
- e. Phase: 3
- f. Enclosure: TEFC
- g. Quantity: 1
- h. Provide exhaust duct system with fan rings, automatic dampers, clean-out doors, roof flanges, weather canopies with birdscreen, and required hardware as needed for complete installation.
- i. Motor to be explosion proof
- j. Provide air safety valve, interlocked with exhaust fan to prevent use of spray equipment when exhaust fan is off.
- k. Motor shall have combination starter/disconnect switch at motor location and local wind up time with 60-minute limit station for operation.
- l. Provide magnetic starter with solid state overload center to control motor.

06 Lights:
- a. Type: LED
- b. Voltage: 120/277 VAC
- c. Phase: 1
- d. Lumens: 8000
- e. Quantity and size: Eight (8) 48 inch modular fixtures
- f. Provide switch for operator controls.
- g. Fixtures to be serviceable from inside the booth and meet and fire/explosion ratings required for paint booth itself.

07 Accessories:
- a. Filters and filter racks for 2-inch thick filters in CFISD standard sizes: 16x20x2, 16x25x2; 20x20x2; and 20x25x2. No other sizes permitted.
- b. Provide paint arrestor pads.
- c. Visible gauge indicating rise in static pressure due to overflow residue accumulation.
- d. Provide filter intake doors if the filter cannot be removed from the front frame or rack
- e. Provide filtered exhaust plenum.
- f. Do not provide doors at front of booth. Paint booth to be open.

08 Prefinished frame and panels with the manufacturer's standard shop paint finish.

09 Spray booth construction and air flow velocities to conform to OSHA requirements.

10 Fire Suppression System: Provide fire sprinkler head(s) in booth, tied to building fire sprinkler system.

PART 3 - EXECUTION

3.1 PREPARATION

A. Obtain dimensions affecting the work of this Section from the site.

B. Obtain electrical and mechanical service characteristics and rough-in location from site.

C. No silicone-based sealants may be used in or around spray booth.

3.2 INSTALLATION

A. Install the paint spray booth in strict accordance with the manufacturer's reviewed submittals and installation instructions.

B. Install the paint spray booth in strict accordance with all governmental agencies having jurisdiction.

C. Coordinate with electrical and mechanical contractors for proper interface.

D. Upon completion of installation and testing, coordinate with Owner to provide complete training on the operation and maintenance of the paint spray booth.
   01 Training shall be conducted by a factory / manufacturer representative.

END OF SECTION

SECTION 11 61 33

THEATRICAL RIGGING AND DRAPERY SYSTEMS

PART 1 - GENERAL

1.1 SECTION SUMMARY

A. This specification describes provision of the theatrical rigging equipment and stage drapery tracks at the Black Box.

1.2 RELATED DOCUMENTS

A. Theatre Rigging Drawings (“TR” Series) and general provisions of the contract including general and supplementary conditions and Division 1 Specification sections apply to this section.

1.3 SECTION INCLUDES

A. Coordination, provision, installation, inspection, commissioning, testing, documentation, instruction and warranties of Theatrical Rigging Systems.

B. Plant, materials, equipment, transport and labor necessary to accomplish this and have a complete and proper System.

C. Also includes:
1. Required licenses and permits including payment of charges and fees.
2. Any required fees for testing, documenting, and notary public services.
3. Verification of dimensions and conditions at the job site.
4. Provision of required pre-installation submittals and project record manuals.
5. Installation in accordance with the contract document, manufacturer's recommendation, and in conformity with applicable codes and authority having jurisdiction.
6. Extension of electrical service, including ground, to equipment locations.

1.4 RELATED WORK

A. Section 11 61 62: Theatrical Lighting Systems.

1.5 REFERENCES

A. Published specification standards, tests or recommended methods of trade, industry or governmental organizations apply to Work in this section where cited below:
1. American Iron and Steel Institute (AISI),
2. American National Safety Institute (ANSI),
3. American Society of Mechanical Engineers (ASME),
4. American Society of Testing and Materials (ASTM),
5. National Electrical Manufacturer’s Association (NEMA),
6. Occupational Safety and Health Administration (OHSA),
7. Underwriters Laboratories (UL),
8. Entertainment Services and Technology Association (ESTA)

9. Entertainment Technicians Certification Program (ETCP)

1.6 DESCRIPTIONS AND REQUIREMENTS

A. The following is intended to further describe the Work and clarify design intent and is not an exhaustive description of the Theatrical Rigging Systems. Refer to the Theatre Rigging Systems (TR Series) drawings for further information relating to this Section.

B. Rigging and Drapery System: Black Box Theater
1. Pipe Grid:
   a. Shall be designed to accept the loads for the intended use.
   b. Shall be suspended from overhead structure as described on the drawings.
   c. Primary support shall be from overhead; provide supplemental bridging strut as required for pipe-grid suspension hardware where structural constraints and obstructions may require its use.
   d. Support shall include side-wall blocking for supplemental support and to prevent lateral movement of the completed assembly and the equipment affixed.
   e. Components of the Theatrical Lighting System shall be integrated on the pipe grid.
2. Curtain Tracks
   a. Provide walk along tracks to support a series of black velour masking panels conceal the walls within the room as described and scheduled on the drawings.
3. Drapery
   a. Drapery for the Black Box shall consist of:
      1) A series of black masking legs suspended from walk-along tracks beneath the pipe-grid system as scheduled and located on the drawings.

C. General Requirements
1. Each rigging component must include the quantity of wire rope lift lines, trim chains, compression sleeve fittings, pipe or truss batten sections, and all necessary hardware for a fully operable rigging system.
2. Draperies shall be constructed of professional grade fabric intended for use as stage curtains. All draperies will be certified as flame retardant as a result of either their inherent characteristics or chemical treatment in accordance with the AHJ.

1.7 RESPONSIBILITY AND RELATED WORK

A. The drawings included with this specification convey general system concepts. The plans do not show complete and accurate building details. The Contractor is responsible for making the field measurements necessary to establish exact locations, relationships, load capacities necessary for the installation of these systems. Coordinate the work with the General, Electrical and other related contractors as stated in Part 1.4, and the scheduled work of other trades.

B. Conduit infrastructure system, including wire for AC Power and grounding for the Theatre Rigging Systems, shall be provided as part of the contract. Coordination between different disciplines is required to achieve a proper conduit system installation and power provisions for Theatre Rigging Systems. The electrical installation shall be in accordance with Division 26 and the National Electric Code.

C. Verify the requirements and integrate components of the theatre lighting power and control system mounted to rigging hardware.

D. Supply accessories and minor equipment items needed for a complete system, even if not specifically mentioned in these Specifications or on the associated Drawings, without claim for additional payment.

E. Notwithstanding any detailed information in the Contract Documents, it is the responsibility of the Contractor to supply systems in full working order. Notify the Architect of any discrepancies in part numbers or quantities before bid. Failing to provide such notification requires Contractor to supply items and quantities according to the intent of the Specifications and associated Drawings without claim for additional payment.

F. Obtain all permits necessary for the execution of any work pertaining to the installation, or any operation by the Owner including any associated charges or fees.

G. Execute all work in accordance with all Standard Authorities listed above, and all applicable State and Local codes, ordinances, and regulations. If a conflict develops between the contract document and the appropriate codes and is reported to the Architect prior to bid opening, the Architect will prepare the necessary clarification. Where a conflict is reported after contract award, propose a resolution of the conflict and, upon approval, perform work.

1.8 QUALITY ASSURANCE

A. Contractor's Qualifications: Firm experienced in the provision of systems similar in complexity to those required for this project; and meet the following:
1. No less than five years' experience with equipment and systems of the specified types under the same business name.
2. Experience with at least five projects of comparable scale within the last two years.
3. Employ only fully trained stage riggers and mechanics for the erection of the stage equipment.
4. All theatrical rigging activity shall be supervised by an ETCP certified theatre rigger.
5. The stage riggers will be completely familiar with the type of equipment to be installed. A competent and knowledgeable Job Superintendent will be on the job at all times when work is in progress.
6. Maintain a fully staffed and equipped service facility.
7. Contractor shall attend pre-installation meetings to coordinate with other trades as required.

1.9 PRE-INSTALLATION SUBMITTALS:

A. The submittal information required by the specification is to be presented complete and as submissions noted below. Submittals are a crucial and integral part of the construction process; as such the Owner's consultant will not recommend payment to the Contractor above 25% of the scheduled value of this work until all submittal information has been approved. Cost for the Owner's consultant to review secondary and re-submittals due to the Contractor's failure to include all required submittal information, or rejection of incomplete or improperly prepared submittal information will be the responsibility of the Contractor. The cost shall be based on the hourly rates of the Architect and consultants as published in their current professional fees schedules and shall also include reimbursable costs for delivery, mailing, and photocopies at direct cost-plus ten percent (10%).

B. Project Submittal Part 1:
1. Provide for approval not later than thirty (30) days after issuance of Notice to Proceed and prior to commencement of Work:
a. Section 1: A complete schedule of submittals.
b. Section 2: A chronological schedule of Work in bar chart form. Revise and resubmit schedule as required to reflect construction progress.

C. Project Submittal Part 2:

1. Provide for approval no later than sixty (60) days after issuance of notice to proceed and in accordance with previously submitted submittal schedule.
   a. Section 1: Complete list of products to be incorporated within the Work.
   b. Section 2: Manufacturer's data sheets for each product. Provide original manufacturer's data sheets in order as they appear in the specification. These data sheets are submitted for each product in sufficient detail to facilitate proper evaluation to the products suitability for incorporation within the Work.
   c. Section 3: Fabric Samples. Submit a sample book of each fabric specified, containing manufacturer's standard colors available in the quality of fabric specified for the Owner's selection and approval of color. More than one color may be selected. After selection, upon request, submit one square foot sample of each fabric in each color for final review.
   d. Section 4: Submit Material Safety Data Sheets (MSDS) for each potentially hazardous material prior to use. Include information pertaining to the hazardous material with the MSDS.
2. Drawings:
   a. Provide computer software generated drawings using standard industry graphic standards. Hand or poorly drawn documents will not be accepted. All drawings shall be created on a computer aided drawing (CAD) system compatible with AutoCAD release 2013. Electronic files of theatrical rigging contract documents shall not be distributed for use in generating submittal documents with the exception of architectural backgrounds.
   b. Drawings depicting attachment of equipment to structure or mechanical assemblies that support overhead loads must show the work has been reviewed and sealed by a structural engineer licensed to practice in the State of Texas.
   c. Installation Drawings. Provide drawings showing special details depicting methods and means specific to each product and each product manufacturer's recommended installation methods and means. Provide assembly and attachment for each product. Drawings should be reviewed and sealed by a structural engineer licensed to practice in the State of Texas.
   d. Schematic Drawings. Provide drawings detailing inter-component and intra-component, on Contractor assembled components or fabricated products.
   e. Conduit and Electrical Drawings. If the system incorporates an electrical or electronic system of any type, provide floor plan drawings, including all walls, doors and rooms, showing exact power requirements and conduit routing for each system with the location of all junction boxes, terminations, etc.
   f. Equipment Drawings. Provide equipment mounting and location details including necessary physical dimensions, clearances, load limits, etc.
   g. Software diagrams showing the hierarchical structure of operator screens and functions with sample screen shots.
   h. Floor plan and Section Drawings. Provide drawings showing the exact location of all installed equipment on floor plans and/or sections such as guide wires or tracks, loft blocks, battens, etc.
   i. Custom Enclosures and Millwork Drawings. If custom enclosures or millwork is required, provide full fabrication detail drawings indicating size, material, finish and openings for equipment.
   j. Fabricated Plates, Panels, or Signage Drawings. If plates, panels, or signage is required, provide complete drawings depicting dimensioned locations of components, component types, engraving or printing information, plate material and color, and bill of material.
   k. Labeling Drawing. Provide representative equipment labeling scheme of locking rail, loading rail, etc.
   l. General Detail Drawings. Provide detail drawings depicting any unique installation methods specific to each product.
   m. Any other pertinent data generated which is necessary to provide the Work.

D. Submittal Format:
1. Electronic submission of submittals is required.
2. Provide each file with a unique number and be numbered in consecutive order.
3. Provide each file with a label the project title and submittal number.
4. Provide each submittal with a complete table of contents with the following information:
   a. Project title and number.
   b. Submittal number. In the case of a re-submittal, use the original submittal number immediately followed by the suffix “R” immediately followed by a unique number and be numbered in consecutive order.
   c. Date of submission.
   d. Referenced addendum or change-order number as applicable.
   e. Referenced specification Section, Part, Article, Paragraph and page number or drawing reference as applicable.
   f. Index Product Data sheets by manufacturer and model or part number.
5. Separate major grouping with labeled binder tabs.
6. Arrange product data list in alpha-numeric order when applicable followed by unspecified product arrange by manufacturer and model or part number. Follow list by manufacturer’s data sheets, arranged in the same order. If a data sheet shows more than one product, indicate the model being proposed with an arrow or other appropriate symbol.
7. Drawings executed at an appropriate scale, not smaller than ⅛” = 1’-0” for conduit/floor plans, ¼” = 1’-0” for equipment layouts, and ½” = 1’-0” for mounting details and plate/panel details.

E. Submittal Copies:
1. These requirements represent minimum project requirements; a project’s general conditions may require additional copies for project distribution.
2. Electronic submission of submittals is required in PDF format.
3. Submit (2) sets of any product or sample finishes as required within this specification.

F. Resubmission Requirements:
1. Make any requested corrections or change in submittals required. Resubmit for review until no exceptions are taken.
2. Indicate any changes that have been made other than those requested.

G. Approval of Submittals: The submittal information will be reviewed by the general contractor, owner, Architects, engineers, and consultant. Each submittal package will be returned, stamped as follows:
1. “No Exceptions Taken” proceed with construction, all job site coordination will be at the direction of the general contractor.
2. “Make Corrections Noted: No Resubmission Required” submittals have been returned with conditional approval. Corrections, as indicated on the returned drawings and/or specifications, must be made before construction can begin.
3. “Make Corrections Noted: Submit Corrected Copy” submittals have been returned with conditional approval. Corrections, as indicated on the returned drawings and/or specifications, must be made in writing and returned to the consultant before construction can begin.
4. “REJECTED, Submit Specified Item” a specified item in the submittal has been rejected for the reasons noted. Re-submit in compliance with the specifications.
5. “REJECTED, Revise and Re-submit” submittal has been rejected for the reasons noted. Re-submit in compliance with the specifications.
6. “No Review Action Required” all information provided was for information or coordination purposes only. Review is not required.

1.10 PROJECT RECORD MANUAL

A. Submit three bound original sets (this is a minimum of two for the Owner and one for the Architect's consultant; additional copies may be required by the project's general conditions) after substantial completion and prior to final inspection.

B. The Project Record Manual shall be segregated into three separate bindings as follows:
1. Operations Manual:
a. Product Data: Product actually incorporated within the Work:
1) Manufacturer's data for each type of product conforming to the scheme above. The list shall include manufacturer's serial numbers.
2) Owner/Instruction Manual for each product.
3) For custom circuits or modifications, a description of the purpose, capabilities, and operation of each item.
4) Manufacturer's wiring diagram for each type of product actually incorporated.
5) Separately bound list by manufacturer and model or part number of all products incorporated within the Work arranged in alphanumeric order.
b. Record drawings: Final rendition of that specified depicting what is actually incorporated within the Work. Provide one (1) full size set and one (1) DVD-ROM containing all CAD generated drawings prepared in conjunction with this project. Drawing files to be in AutoCAD Release 2010 DWG format.
c. Test Reports: Recorded findings of testing specification of this specification.
d. System Operation and Instructions: Prepare a complete and typical procedure for the operation of the equipment as a system, organized by subsystem or activity.
1) This procedure should describe the operation of all system capabilities.
2) Assume the intended reader of the manual to be technically experienced but unfamiliar with the components and the facility.
2. Service & Maintenance Manual:
a. Provide an original copy of the service manual on every piece of equipment for which the manufacturer offers a service manual. Arrange manuals in the same order as the operations manual.
b. Manufacturer's maintenance and care instructions.
c. Maintenance Instructions, including maintenance phone number(s) and hours; maintenance schedule; description of products recommended or provided for maintenance purposes, and instructions for the proper use of these products.
d. Replacement parts list of all minor equipment such as fuses, lamps, connectors, knobs, etc.
3. Warranty Manual:
a. Manufacturer's warranty statements on each product.
b. Date of substantial completion and ending dates for warranties for each group of products.
c. Software registration and licenses.

C. Include any other pertinent data generated during the Project or required for future service.

D. Appropriately duplicate data within the separate bindings when it will reasonably clarify procedures, e.g., operational data in maintenance binding.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Ship product in its original container, to prevent damaging or entrance of foreign matter.

B. Handling and shipping in accordance with manufacturer's recommendation.

C. Provide protective covering during construction, to prevent damaging or entrance of foreign matter.

D. Replace at no expense to Owner, product damaged during storage, handling or the course of construction.

1.12 PROJECT CONDITIONS

A. Verify conditions on the job site applicable to this work. Notify Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.

B. The Drawings diagrammatically show arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install work as shown, recommend solutions and/or submit drawings to the Architect for approval, showing how the work may be installed.

1.13 FINAL INSPECTION AND TESTING

A. Upon completion of installation, initial adjustments, tests and measurements specified in Part 3, and submission and review of the results, a final inspection and test will be observed by the Architect and/or Architect's Consultant no earlier than two weeks after receipt of the written results.

B. Provide a minimum of one (1) person for inspection and testing familiar with aspects of the System to assist the Owner.

C. The process of testing the System may necessitate moving and adjusting certain components such as counterweights on arbors, adjustment of drapery tracks, etc.

D. Testing includes operation of each major system and any other components deemed necessary. Perform tests and provide required test equipment, tools and material required to make any necessary repairs, corrections, or adjustments.

E. The following procedures will be performed on each System:
1. Inspection of the methods and means employed to incorporate the System within the facility.
2. Verification of proper operation, from controlling devices to controlled devices.
3. Verification of proper adjustment, balance, and alignment of equipment for optimum quality and to meet the manufacturer's published specifications. Establish and mark normal settings for each setting, and appropriately record these settings within the Record Documents.
4. Other tests on equipment or systems deemed appropriate.

F. In the event the need for further adjustment or work becomes evident during testing, the Contractor is to continue work until the System is acceptable at no addition to the contract price. If approval is delayed because of defective equipment, or failure of equipment or installation to meet the requirements of these specifications and any extension of the inspection and testing period is required, the contract price will be reduced for the additional time and expenses of the Owner, at the standard rate in effect at that time.

G. Rigging system Contractor shall return to the jobsite six months after acceptance to inspect the rigging hardware and attachments, curtain tracks, curtains, and battens.

1.14 WARRANTY

A. Warrant labor and product for two (2) years following the date of substantial completion to be free of defects and deficiencies, and to conform to the drawings and specifications as

to kind, quality, function, and characteristics. Repair or replace defects occurring in labor or product within the Warranty period without charge. Any cost required to complete this warranty repair is the responsibility of the contractor.

B. This warranty is in addition to any specific warranties issued by manufacturers for greater periods of time.

C. Within the warranty period, answer service calls within eight hours, and correct the deficiency within twenty-four hours.

D. This warranty will include two (2) Level 1 ANSI-compliant annual inspections. The inspection will be a level one inspection for manually operated systems and a level two inspection for all motorized equipment. The first will occur 1-year after the project's substantial completion, and the second shall occur before the end of the two (2) year warranty. The Contractor shall provide the inspections at no cost to the Owner and at an agreed-upon time and date. The Contractor shall provide a full report with deficiencies or findings. All repairs covered by applicable warranties will be completed.

1.15 INSTRUCTION OF OWNER PERSONNEL

A. After final completion, provide instruction to Owner and/or the Owner's designated personnel on the use, operation, maintenance and care of the System.
   1. Develop training course based on the use of the System and manufacturers' recommendation. Provide (10) hours of training. The training period shall be divided into two segments and shall be scheduled at least two weeks apart. All training shall be scheduled at the convenience of the owner and designated personnel.
   2. Submit an outline of the course with sample instructional aids for approval (30) days prior to scheduled instruction sessions.
   3. If a representative of the manufacturer is used in the instructional course, the Contractor must be present throughout the extent of the course and ensure that the representative abides by the requirements set forth in these specifications.

B. Rigging system Contractor shall be present at the first two (2) uses of the facility.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Model name and number for manufacturers included in this specification are listed to establish a standard of product quality.

B. Substitution of specified products with other qualified manufacturers and products will be considered providing:
   1. Proper substitution procedures outline under Division 1 is adhered to.
   2. A request for substitution of each specific product must be made in writing by a bidding Contractor not less than ten (10) business days prior to bid for written approval of the Architect.
   3. Sufficient data of the products is presented for prior approval including technical data, manufacturer's specifications, samples, and, if requested, results of independent testing laboratory tests.
   4. Written permission is obtained for the substitution from the Owner or Owner's Representative.

C. If proposed system includes equipment other than specified model numbers, submit a list of major items and their quantities, with a one-line schematic diagram for review. Include

a list of previously installed projects using proposed equipment that are similar in nature to specified System.

D. Provide product not specifically specified commensurate with the quality and standards established by the specified product.

2.2 GENERAL

A. Products shall be new, free from defects and listed by UL when an applicable UL Standard exists. Provide product of a given type from one manufacturer.

B. Regardless of the length or completeness of the descriptive paragraph herein, provide product complying with the specified manufacturers' published specifications.

2.3 CONTACTS

A. Listed below is contact information for Manufacturers of rigging components approved to provide equipment on this project:

B. Automatic Devices Company
1. 2121 S. 12th Street, Allentown, PA. 18103
2. Telephone: (610) 797-6000
3. Approved to supply curtain track and curtain motors.

C. Wenger (JR Clancy)
1. 7041 Interstate Island Road, Syracuse, NY 13209
2. Telephone: (315) 451-3440
3. Approved to supply stage rigging components, motorized hoists, hoist control, fire safety curtains and accessories, beam clamps, and associated hardware.

D. Crosby Group, Inc.
1. P.O. Box 3128, Tulsa, Oklahoma 74101
2. Telephone: (918) 834-4611
3. Approved to supply rigging hardware including chain, cable clips, cable, and anchor shackles.

E. Electronic Theatre Controls
1. 3031 Pleasant View Rd, PO Box 620979, Middleton WI 53562
2. Telephone (608) 831-4116
3. Approved to supply rigging hoists and controls.

F. H&H Specialties
1. P.O. Box 9327, South El Monte, Calif. 91733
2. Telephone: (213) 283-3562
3. Approved to supply stage rigging loft/head blocks, curtain tracks, and curtain motors.

G. K&M Fabrics
1. 2 Waco Street, Greenville, South Carolina 29611
2. Telephone: (800) 845-1896
3. Approved to supply curtain fabric.

H. J.B. Martin
1. 445 rue St-Jean-sur-Richelieu, Quebec, Canada J3B 2M1
2. Telephone: (514) 346-6853
3. Approved to supply curtain fabric

I. Safety Technology International, Inc.
1. 2306 Airport Road, Waterford, MI 48327
2. Telephone: (248) 673 9898
3. Approved to supply polycarbonate device covers.

J. Texas Scenic Company
1. 8053 Potranco Rd, San Antonio, Texas 78251
2. Telephone: (210) 684-0091
3. Approved to supply rigging Hoists and controls, rigging hardware, stage drapery, fire curtain systems.

K. Thern, Inc.
1. 5912 Industrial Park Rd, Winona, Minnesota, 55987
2. Telephone: (800-553-2204
3. Approved to supply stage rigging components, motorized hoists, hoist control, fire safety curtains and accessories, beam clamps, and associated hardware.

L. Ver Sales, Inc.
1. 2509 N. Naomi Street, Burbank, Ca. 91504
2. Telephone: (818) 567-3000
3. Approved to provide rigging hardware including chain and beam clamps.

M. IWeiss
1. 815 Fairview Avenue Suite 10, Fairview, New Jersey, 07022
2. Telephone: (201) 402-6500
3. Approved to supply rigging hardware, stage drapery, stage rigging loft/head blocks, and curtain tracks.

N. Rose Brand Fabrics
1. 4 Emerson Lane, Secaucus, NJ 07094
2. Telephone: (800) 223-1624
3. Approved to supply drapery, hampers, and miscellaneous associated equipment.

O. Liba Fabrics Corp.
1. 132 W 36th St. 6th Floor, New York, NY 10018
2. Telephone: (212) 563-4991
3. Approved to supply curtain fabrics

2.4 RIGGING HARDWARE

A. Batten Assembly
1. Pipe battens shall be constructed of new ASTM A53/A 1-1/2" nominal schedule 40 plain end steel pipe.
2. Battens exceeding one standard pipe length will be joined using an internal splicing sleeve. Splices must provide the same overall capacity, deflection, and strength to the pipe battens as an un-spliced span. Threaded couplers are not permitted.
   a. Splice sleeves shall be a minimum of 18" in length with a minimum of 9" extending into each pipe batten.
   b. Sleeves will be machined to a diameter that will create a snug fit within the pipe battens.
   c. Splicing sleeves will be fastened to the pipe batten with pins or 3/8” diameter bolts. Locate at least two fasteners on each side of splice joint; alternate direction of fasteners at right angles to one another across the diameter of the pipe.
3. Any fasteners used on pipe battens must meet SAE grade 5, and be equipped with self-locking nuts.

4. Cover the end of each batten with a yellow or white closed end, soft vinyl safety cap at least 4 inches in length. Cap shall display linesets maximum capacity, and lineset number.

B. Batten Connections
1. Wire rope lift lines shall terminate directly to trim chains constructed of NACM chain certified by their manufacturer as suitable for the intended purpose.
2. Chain shall be ¼" diameter or larger, and of sufficient length to wrap one and one-half times around the pipe batten and return to the eye of the wire rope lift line.
3. One chain end shall be terminated directly to the wire-rope eye, the other end secured with a forged screw pin anchor shackle rated for the intended purpose. The screw pin shall be moused or seized to ensure the pin will not release.
4. Alternative designs for batten connection and trimming methods shall require approval as part of the submittal process.
5. Where a pipe clamp may be required on a batten, a wrap-around type clamp shall be provided. This clamp shall be secured to the pipe using SAE 5 grade bolts, washers, and self-locking nuts.
6. Acceptable products:
   a. Clancy Alpha Chain
   b. 7 mm (0.275″) Grade 63 alloy chain

C. Wire Rope Lift Lines
1. Provide lift lines and fittings appropriate for supporting the load requirements.
2. For utility and drapery sets:
   a. Lift lines shall be a minimum of $^{3}/_{16}$" diameter 7 X 19 construction, galvanized aircraft cable with a breaking strength of 4200 lbs.
3. For shell and stage electric sets:
   a. Lift lines shall be a minimum of $^{1}/_{4}$" diameter 7 X 19 construction, galvanized aircraft cable with a breaking strength of 7000 lbs.
4. All wire rope must be new; damaged or deformed cable may not be used.
5. Exposed ends of wire rope shall be cut cleanly, then seized.

D. Wire Rope Termination
1. To connecting hardware, form eyes around an appropriately sized thimble using copper Nicopress® compression sleeves.
2. To cable drums: terminate the wire rope on the inside of the lifting drum using a Nicopress® compression stop sleeve.
3. Supply and install compression sleeves or clips in size and quantity per guidelines set forth in the Wire Rope User's Manual, by its manufacturer's specifications, and in accordance with industry guidelines.

E. Rigging Accessories:
1. In certain instances special component parts, such as sheaves, idler blocks, extra lines, etc., will be necessary in order to provide a fully operable system. Where such requirements are necessary, furnish, install, and adjust these components comparable to the quality of the products listed in these specifications.
2. Acceptable manufacturers:
   a. H&H Specialties
   b. JR Clancy
   c. Crosby

2.5 STAGE DRAPERIES TRACKS

A. Straight Draw Curtain Tracks
1. Provide and install the curtain tracks as located and configured on the drawings.

2. Track shall be constructed of 14 gauge galvanized steel, roll formed to a 2-⅝" W X 2-¾" H channel with continuous slot in bottom. Provide un-spliced lengths up to 26' in length.
3. Track must mount to pipe battens on maximum 5'-0" centers with two-piece hangers formed from 11 gauge steel.
4. Provide a minimum of 2'-0" overlap in the center. Separate tracks at center with two overlap clamps.
5. Install carrier stops with at each end of track.
6. Provide single carriers, spaced 12" on center, constructed of (2) nylon-tired ball bearing wheels fastened parallel to carrier body. Supply carriers with heavy duty hook, swivel eye, and trim chain for attachment of drapes. Install neoprene bumper between each carrier to reduce noise.
7. Provide master carriers with 4-wheel nylon-tired ball bearing assemblies with bodies formed from 11 gauge steel. Connect to operating line with two formed steel cord clamps attached to each body. Supply each master carrier with two heavy duty hooks, swivel eyes, and trim chains for attachment of leading edge of drape.
8. Single and double end pulleys will clamp securely to the underside of the track channel and will be equipped with 6" diameter Nylatron GS sheaves grooved for up to ½" hand line. Install (2) ⅝" sealed precision ball bearings in each sheave. Lock shaft to side plate on head end with $^{3}/_{16}$" keeper pin to prevent rotation and install fine threaded nylon insert lock nut.
9. Dead end pulley shall be mounted at 45 degrees from the traveler tracks to reduce clearance required for pulley between pipe battens.
10. Provide a sand bag tension pulley for operation of hand line of the mid-stage traveler. Provide adequate quantity of sand for proper hand line operation.
11. Hand line shall be ½" diameter, stretch resistant rope with spun polyester outer jacket double braided over solid polyester core.
12. Acceptable products:
    a. H&H Specialties series 400
    b. ADC series 280

B. Walk-along Curtain Tracks
1. Provide materials and the labor to install the curtain tracks as located and configured on the drawings.
2. Track shall be made of 6063-T5 aluminum, extruded into 2-½" I-beam with 1" wide top, intermediate and bottom flanges. Provide un-spliced lengths up to 24' in length.
3. Track must mount to pipe battens on maximum 5'-0" centers with two-piece hangers formed from 11 gauge steel hangers.
4. Provide single carriers, spaced 12" on center, constructed of (2) Delrin wheels fastened parallel to formed steel carrier body. Supply carriers with swivel hook for attachment of drapes. Install Nylatron wear strips at contact points to act as a bumper between each carrier to reduce friction. Provide neoprene bumpers between each carrier to reduce noise.
5. Provide walk along handles attached to the master carriers for operation of the curtain.
6. Provide end stops at each end of the track.
7. Ensure that all steel components are zinc plated for corrosion resistance.
8. Provide all track and associated hardware factory coated BLACK
9. Acceptable products:
    a. H&H Specialties series 300
    b. ADC series 140

2.6 STAGE DRAPERY STAGE DRAPERY

A. General Specification for Stage Drapery

1. Provide and install all curtains as located and scheduled on the drawings.
2. Field verify all dimensions prior to fabrication of draperies.
3. Curtain fabric of professional grade fabric intended for stage use. If not inherently flame retardant, curtain fabric shall be chemically flame proofed at the mill using an immersion process. Flame proofing certificates for all fabrics used shall be furnished to the owner with the as-built drawings.
4. Sew tags identifying manufacturer and size of panel at each end of webbing at top and at one corner at hem in each drape.
5. Curtains must be constructed with vertical seams unless otherwise specified. The fabric grain shall run nap down and match in all panels. All panels must be un-spliced along their height.
6. Construction
   a. Black Poly webbing at 3” wide shall be double stitched to the top of the curtain with 1” of face fabric turned under the webbing.
   b. Brass rustproof grommets shall be inserted
      1) at the extreme top corners
      2) in the pleat centers of curtains sewn with fullness, or
      3) on 12” centers for flat curtains.
   c. Grommet holes for track mounted curtains shall be supplied with
      1) plated wire “S” hooks, or
      2) snap hooks, sewn-in at the spacing noted above.
   d. Drapery hung directly from an auxiliary batten shall have a 24” long black cotton tie line fastened in each grommet hole.
   e. The centerline of the drape shall be marked on the top webbing with “CL” and a white tie line added to the corresponding grommet.
   f. Curtains sewn with fullness shall have box pleats spaced 12” on center.
   g. Bottom hems shall be 4” wide. These shall be sewn with a separate canvas chain pocket inside so that the bottom of the canvas pocket rides 2 inches above bottom of the hem. Provide #8 plated jack chain in the pocket.
   h. All traveling curtains shall be sewn with a minimum 24” of face fabric turned back at the leading edge. All other vertical hems shall be 2”.
7. Use mercerized cotton thread, minimum weight of #16, color to match drape fabric.
8. Sew a 12” x 12” swatch of fabric near the lower offstage corner of each drapery for fire-resistance testing by the AHJ.
9. Fabric colors shall be as scheduled. Submit color sample card with submittal documents. Make all effort to ensure that curtains of the same color are fabricated from fabrics of the same dye lot.
10. Labeling
    a. Sew labels onto the back (in most cases, upstage) side of the upper hem at both ends of each panel.
    b. Curtains must have NFPA 701 flameproof certification tag sewn on the bottom of each curtain panel for Fire Inspection reference. This label should have permanent stitching around all four sides.
    c. Labels shall clearly indicate
       1) date of manufacture
       2) cloth type
       3) manufacturer's name and address
       4) size (width and height using 3/4" minimum lettering
       5) owner's designated inventory number
11. Acceptable product:
    a. For nominal 24-25 ounce fabric
       1) KM Fabrics Charisma inherently flameproof velour.

2.7 FIXED BATTENS AND LIGHTING PIPES

A. Provide pipe assemblies attached to structure as described in the drawings.

B. Assemblies shall be constructed of new ASTM A53/A 1-½" nominal schedule 40 plain end steel pipe.

C. Pipe Grid Configuration
1. Cross-over Clamps
   a. Intersecting pipes shall be joined with specialty hardware to clamp, join, and support pipe-grid segments. Clamps shall have a recommended working load of at least 1,500 lbs. U-bolts are not acceptable.
   b. Acceptable product:
      1) JR Clancy Cross-Over Clamp
      2) Approved equal.
2. Each pipe shall terminate just off the wall. Internally sleeved wall plates shall securely brace the grid against the wall once it is in place. Supply sufficient braces to prevent lateral movement of the pipe grid.
3. Suspension
   a. The grid shall be rigidly hung from the overhead steel structures on centers at nominal 4 ft. x 4 ft. intervals, and not exceeding 8 feet in either direction. Suspension methods shall be either:
      1) Pipe-hangers suitable to the intended load and SAE grade 5 threaded rod, or
      2) ¼-inch, 7x19 galvanized utility cable ending in 6 inches x 3/8 inch (152.4 mm x 9.5 mm) forged turnbuckles attached to pipe clamps.

2.8 COMPLETED SYSTEM

A. General
1. All installation of stage rigging equipment shall be completed utilizing new materials, free from flaws and rust, and in good working order. The jobsite shall be cleaned of all packing materials, lubricants, metal shaving, miscellaneous hardware, and components not used in the installation.
2. All dimensions are to be field verified. Location and attachment of hardware and size of components shall be confirmed by the Contractor.
3. All electrical power, outlets, related systems, and structural elements required to make the system fully functional re the responsibility of the Contractor.
4. If components and hardware are not specifically specified or called out, it is the responsibility of the Contractor to provide those components in order to provide a fully operational theatrical rigging system.

B. Trimming/Leveling of Drapery
1. Contractor is to return to the jobsite within sixty (60) days, but not less than thirty (30) days of the installation to re-trim all tracks and curtains.
2. Provide documented notes on site visit to Architect and Architect's Consultants on adjustments made during return visit.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate incorporation of the Work specified herein with other project work so as to facilitate a cohesive final product.

B. Mount equipment and enclosures plumb and level.

C. Permanently installed equipment to be firmly and safely held in place in accordance with specified safety factors and Federal and State codes and regulations.

D. Work shall be completed within industry guidelines, including, Entertainment Services and Technology Association (ESTA), OSHA, National Electric Code, American National Standards Institute, American Society for Testing and Materials, American Institute of Steel Construction, National Fire Protection Association, National Electrical Manufacturers Association, plus any or all local, governmental, or other applicable codes.

E. Where dimensions and loading capacities have been omitted from this specification, they are to be determined by the Contractor, in accordance with the accepted industry standards and guidelines in this section. In no way will the theatre rigging contractor be relieved of primary responsibility to provide a safe, fully functional system.

F. The mechanical fabrication and workmanship will incorporate the best practices for good fit and finish. There will not be any burrs or sharp edges to cause a hazard, nor will there be any sharp corners accessible to personnel.

G. All equipment will be installed based on the manufacturer's recommendations and for the use intended by the manufacturer.

H. All shop and field welding will meet the qualifications of the AISC manual and will be without spatter or other evidence of poor practices.

I. All finishes which are disturbed during shipping and installation will be touched up to match the original.

J. Materials will conform to the following ASTM standard specifications:
1. A-36 structural steel
2. A-36 steel plates and bars
3. A-47 malleable iron casting
4. A-48 gray iron casting
5. A-53 welded and seamless steel pipe
6. A-120 black and hot dipped zinc-coated steel pipe

K. In order to establish minimum standards of safety, the following factors will be used:
1. cables and fittings provide a minimum 8:1 design factor
2. cable bending ratio is 30 times the cable diameter
3. nuts and bolts use minimum SAE grade 5 (ASTM rating A-449)
4. thread pressure of
   a. 500 lb. for cast iron
   b. 1000 lb. for steel
   c. 1500 lb. for Nylatron
5. steel designed to 1/5 of yield
6. bearings are rated for two times the required load operating at full speed for 2000 hours.

3.2 INSTALLATION OF STAGE DRAPES AND TRACKS

A. Install all tracks and hardware according to manufacturer’s recommendations.

B. Stage draperies shall be installed near the end of the installation when chances of damage from other work are reduced. Stage area shall be broom clean with no further construction taking place prior to installation.

C. After hanging stage draperies, thoroughly brush to remove dust, visible dirt, loose threads, loose fabric lint, etc. Wrinkles will be allowed to fall out naturally.

3.3 LABELING OF EQUIPMENT

A. Mark and label each batten with its set number, load/arbor capacity, stage centerline, and lift line locations with appropriate paint.

B. Provide labels clearly indicating date of manufacture, cloth type, manufacturer's name and address, size (width and height using 3/4" minimum lettering), and Owner's designated inventory number (to be coordinated with Owner) will be sewn into the back (in most cases, upstage) side of the upper hem at both ends of each drape panel.

3.4 CONTRACTOR COMMISSIONING

A. Prior to energizing or testing the System ensure the following:
   1. Products are installed in proper and safe manner according to manufacturer’s instructions.
   2. Dusts, debris, solder splatter, etc. is removed.
   3. Labeling has been provided.
   4. Temporary facilities and utilities have been properly disconnected, removed and disposed of off-site.
   5. Products are neat, clean and unmarred and parts securely attached.
   6. Broken work, including glass, raised flooring and supports, ceiling tiles and supports, walls, doors, etc. have been replaced or properly repaired, and debris cleaned up and discarded. Job site shall be left broom clean.

B. Provide two portable VHF or UHF business band radios for use during acceptance testing with transmission range sufficient to cover entire project.
   1. Include rechargeable batteries and re-charger along with "holster" for wearing on belt.
   2. Radios to be available for duration of testing process, including any follow-up visits required prior to final acceptance.

END OF SECTION 11 61 33

SECTION 11 61 62

THEATRICAL LIGHTING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Provision of the Theatrical Lighting Systems at Cypress Falls High School.

1.2 RELATED DOCUMENTS

A. Theatre Lighting Systems Drawings (“TL” Series) and general provisions of the contract including general and supplementary conditions and Division 1 Specification sections apply to this section.

B. Section 11 61 33: Theatrical Rigging Systems and Stage Draperies, drawings, and documentation.

C. Section 27 41 16: Integrated Audio-Visual Systems and Equipment, drawings, and documentation

D. Division 26: Electrical Work drawings and documentation

1.3 SECTION INCLUDES

A. Project instructions for the Contractor and System description details.

B. System product descriptions.

C. Project completion instructions for the Contractor.

1.4 RESPONSIBILITY AND RELATED WORK

A. Coordination, supply, installation, shipping, storage, inspection, commissioning, testing, instruction and warranties of the Theatrical Lighting Systems.

B. Plant, materials, equipment, transport and labor necessary to accomplish this and have a complete and fully functioning System.

C. Also includes:
   01 Required licenses and permits including payment of charges and fees.
   02 Verification of dimensions and conditions at the job site.
   03 Provision of submissions.
   04 Installation in accordance with the Contract Documents, Manufacturer's recommendation, and in conformity with applicable codes and authority having jurisdiction.
   05 Extension of electrical service, including ground, to equipment locations.

D. The drawings included with this specification convey general system concepts. Where the plans do not show complete and accurate building details, the Contractor is responsible for making field measurements necessary to establish exact locations, relationships, and load capacities necessary for the installation of these systems.

E. Coordinate the work with the related documents and the scheduled work of other trades.

F. Conduit infrastructure system, including wire for AC Power and grounding for the Theatrical Lighting Systems, are provided as part of the Contract. Coordination between different disciplines is required to achieve a proper conduit system installation and power provisions for Theatrical Lighting Systems.

G. Supply accessories and minor equipment items needed for a complete and fully operational system, even if not specifically mentioned in these Specifications or on the associated Drawings, without claim for additional payment.

H. Notify the Architect of any discrepancies in part numbers or quantities before bid. Failing to provide such notification requires the Contractor to supply items and quantities according to the intent of the Specifications and associated Drawings without claim for additional payment.

I. Specifications and drawings are complementary. Work called for by one is binding as if called for by both. Any discrepancies between specifications and drawings shall be brought to the attention of the Architect for clarification during the bidding period. No allowance shall subsequently be made to the Contractor by reason of their failure to have brought said discrepancies to the attention of the Architect.

J. Execute all work in accordance with the NEC and all applicable State and Local codes, ordinances, and regulations.

K. If a conflict develops between the Contract Documents and the appropriate codes and is reported to the Architect prior to bid opening, the Architect will prepare the necessary clarification. Where a conflict is reported after contract award, propose a resolution of the conflict and, upon approval, perform work.

1.5 REFERENCES

A. Published specification standards, tests or recommended methods of trade, industry or governmental organizations apply to Work in this section where cited below:
   01 American National Standards Institute (ANSI)
   02 American Society of Testing and Materials (ASTM)
   03 Electronics Industries Association (EIA)
   04 Institute of Electrical and Electronic Engineers (IEEE)
   05 National Electrical Manufacturer's Association (NEMA)
   06 National Electrical Code (NEC)
   07 National Fire Protection Association (NFPA)
   08 Underwriters Laboratories (UL)
   09 Occupational Safety and Health Administration (OSHA)
   10 Entertainment Services and Technology Association (ESTA)
   11 United States Institute of Theater Technology (USITT)
   12 Illuminating Engineering Society (IES)

1.6 DEFINITIONS

A. In addition to Division 1 definitions, the following list of terms as used in this Section shall be defined as:
   01 Owner – Cypress Fairbanks ISD
   02 Project – Cypress Falls High School Black Box
   03 Consultant(s) – The Owner's Technical Representative(s) for this Section
   04 Architect – Arcadis
   05 Contractor – The provider of all material, labor, and equipment necessary for the systems described in this Section

06 Furnish/Supply – To purchase, procure, acquire, and deliver complete with all necessary accessories (CWANA)
07 Install – To set in place, join, attach, link, set up or otherwise connect together and test until complete before turning over to the Owner, all parts, item, or equipment supplied by the contractor.
08 Provide – To furnish and install

1.7 DESCRIPTIONS AND REQUIREMENTS

A. Lighting and Control System: Black Box Theater
01 The Black Box Theatre lighting system shall be comprised of a dedicated network-based control system communicating with the distributed power system and DMX devices to control all lighting elements within the facility.
02 The lighting control console may be located variously within the Black Box and control room. Console shall operate directly over the network.
03 Motorized breaker panel (MBP) shall be located in the designated equipment room. An equipment rack provided in the 27 41 16 scope of work will contain all network and DMX interface control components.
04 Remotely switched power shall be distributed throughout the theatre in flush or surface wall-mounted and batten-mounted devices.
05 Network control shall be distributed throughout the Black Box through a series of plug in ports for use with portable network node equipment and fixed network DMX nodes.
06 Architectural Lighting system shall be capable of supporting the same DMX values as the control console so that looks may be snapshotted then recalled through architectural station presets. This will include control of switched performance lighting circuits, dimmed and switched architectural fixtures.
07 Architectural lighting control stations shall be located throughout the spaces in areas where architectural, work, and running lights will be accessed. Stations shall range from master touch screen to pushbutton preset recall stations. The system shall have the ability to “lock-out” stations in order to avoid nuisance switching during performance.
08 Provide theatrical lighting fixtures and required accessories. Installation is required under this base specification and shall include:
a. Hang and rough focus to the Owner’s selected hanging plot.
b. Set-up, addressing and patch.
c. Verification of proper operation and associated training.

B. Focus
01 Contractor will hang, focus, and program lights to an Owner directed plot
02 The Owner may elect to generate their own plot. If not, the Consultant will provide this documentation.
03 If the Contractor finds any needed updates or changes before hang begins the Consultant or Owner will update the documents as needed.
04 The Contractor is responsible for tracking and updating all changes to the plot after it has been turned over for installation. These updates and changes may be provided to the Consultant as necessary. However, the Contractor is responsible for these updates and may be provided the plot in an editable format to make the updates.
05 The Consultant produced plot will provide the following information if applicable for each fixture:

a. Location
b. Unit number for that location
c. Type
d. Area/purpose

e. Mode
f. Fixture universe/address

06 As part of turnover documents, the Contractor will be required to ensure the following are provided:

a. An electronic version of the plot. Provided on a flash drive and preserved by the Contractor for at least the length of the warranty.
b. A B-sized version of the plot mounted to foamcore-like material.
c. All of the information listed above in number 5 and additionally all circuiting of fixtures.

07 As part of the final observation and testing (3.5) Consultant will verify the focus. The Contractor may elect to complete the focus before the final observation and make any changes noted by the Consultant at this time. If the Contractor elects to have the Consultant direct focus as part of final observation the following shall be provided:

a. At least (10) days notice
b. A board operator
c. At least (2) people to perform the focus
d. All required lifts and safety equipment
e. A focus target. Person or figure
f. Person or system to document any changes that arise as part of the focus

C. Console Programming

01 The Contractor shall create a starting show file for the project. The file will be loaded onto the console, provided to the Owner on a flash drive, and preserved by the Contractor for at least the length of the warranty. The Contractor will provide the starting show file to the Owner, if requested, following the requirements laid out in the warranty portion (1.14) of this specification and shall be considered a service call.

02 Owner may select to add, update, or change any of the information below. These changes may be directed before, during, or after initial training. The Contractor will make any requested changes provided any amount of training time is left in the project as outlined in the instruction of Owner personnel of this specification (3.6).

03 At the Owner's request program any fixture, color, or controllable attribute to provided faders.

04 Ensure all areas outlined in the console programming portion of this specification are covered as part of the instruction of Owner personnel of this specification (3.6).

05 Using the provided plot, the Contractor shall create the following console programming at a minimum, if applicable:

a. Patching
b. Patch all fixtures to channel numbers outlined in the plot.

06 Groups

a. (1) group for every area of the plot.
b. (1) group for every "row" of lights from the left
c. (1) group for every "row" of front from the right
d. (1) group for every "row" of top lights

07 Palettes

a. Intensity
    1. Provide a 70% intensity palette for use in creating cues
b. Color
    1. Provide warm (R02) and cool (R3202 or R60) for ease of selection.

2. Provide a red (R27), green (R90), and blue (R80) for use on cyclorama fixtures
3. A warm white. Roughly 3200K

08 Interactive Control Display (Magic Sheet)

a. Provide an interactive control display to aid in programming and console use
b. The interactive display shall utilize a combination of standard and user-defined symbols to generate a fixture layout which copies the light plot as closely as reasonably possible.
c. Selectable fixtures will, at a minimum, indicate the following parameters or palettes and their current states:
1. Fixture type
2. Channel
3. Intensity
4. Color
d. Provide controls for all groups as described above

1.8 QUALITY ASSURANCE

A. Contractor's Qualifications: Firm experienced in the provision of systems similar in complexity to those required for this project; and meet the following:
01 No less than five (5) years of experience with equipment and systems of the specified types.
02 Experience with at least five (5) comparable scale projects within the last two (2) years.
03 Engage the services of a Manufacturer certified technician.
04 Be a franchised dealer and service facility for the manufacturer's products furnished.
05 Maintain a fully staffed and equipped service facility.
06 At the request of the Architect, demonstrate that:

a. Adequate plant and equipment are available to complete the work.
b. Adequate staff with commensurate technical experience is available.

B. Manufacturer's Qualifications:
01 No less than five (5) years continuous experience in the production of specified type of product.
02 Production shall meet applicable NEMA standards.

1.9 SUBMITTALS:

A. Provide submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures section unless otherwise indicated.

B. The submittal information required by the specification is to be presented complete and as submissions noted below. Submittals are a crucial and integral part of the construction process; as such the Owner's consultant will not recommend payment to the Contractor above 25% of the scheduled value of this work until all submittal information has been approved.

C. Submittals must be original work produced by the firm responsible for performing the work defined in this specification. Scanning, photographic copying, materially copying, or any other reproducing the contents of the drawings or specifications contained within the Contract Documents will be marked as unacceptable and not reviewed for any content. No claim shall be made for delay, undue burden, or additional costs for the effort to produce

shop drawings, schedules, and equipment lists addressing this specification or the overall project manual.

D. Project Submittal Part 1:
   01 Provide for approval not later than thirty (30) days after issuance of Notice to Proceed and prior to commencement of Work:

      a. Section 1: A complete schedule of submittals.
      b. Section 2: A chronological schedule of Work in bar chart form. Revise and resubmit schedule as required to reflect construction progress.

E. Project Submittal Part 2:
   01 Provide for approval no later than sixty (60) days after issuance of Notice to Proceed and in accordance with previously submitted submittal schedule.
   02 Products:

      a. Section 1: Complete list of products to be incorporated within the Work (Bill of Materials).
      b. Section 2: Manufacturer's data sheets for each product.
         1. Provide original manufacturer's data sheets in order as they appear in the specification.
         2. Data sheets are required for each product in sufficient detail to evaluate product suitability for incorporation within the Work.
         3. Product literature shall include documentation of UL Listing or approved recognition by a Nationally Recognized Testing Laboratory (NRTL).
      c. Section 3: Provide Architect and/or Architect's Consultant with samples of wall plate materials and colors as specified in this section.
      d. Section 4: Submit Safety Data Sheets (SDS) for each potentially hazardous material prior to use. Include information pertaining to the hazardous material with the SDS.
   03 Drawings:

      a. Provide computer software generated drawings using standard industry graphic standards. Hand or poorly drawn documents will not be accepted. All drawings shall be created on a computer aided drafting (CAD) system. Electronic files of theatrical lighting contract documents shall not be distributed for use in generating submittal documents with the exception of Architectural backgrounds.
      b. Schematic Drawings.
         1. Provide drawings detailing cabling-riser intent.
         2. Give each component a unique designator and use this designator consistently throughout the project.
         3. Include inter- and intra-component connections and cabling diagram depicting cable types, designators, and color codes.
      c. Installation Drawings.
         1. Provide drawings showing the coordinated locations of all installed equipment. Drawings shall include floorplans and other views as necessary to fully describe the intended finished conditions.
         2. Provide Conduit and Electrical Drawings indicating:
            a) Conduit sizing/routing for each system component,
            b) Locations where power is required along with the location of all junction boxes.
         3. Detail Drawings: Provide drawings showing special details depicting methods and means specific to each product, assembly and each product Manufacturer's recommended installation methods and means.

d. Equipment Drawings:
   1. Rack and Panel Elevations: Provide a front elevation of all racks and/or panels.
   2. Rack and Panel Assembly Details: Provide drawings showing location of equipment in racks with dimensions; wire routing and cabling within housings; AC power outlet and terminal strip locations.
   3. Custom Enclosures and Millwork Drawings: Provide full fabrication detail drawings indicating size, material, finish, and openings for equipment.
   4. Fabricated Plates and Panels Drawings: Provide complete drawings of custom fabricated plates or panels. Drawings to include dimensioned locations of components, component types, engraving information, plate material and color, and bill of material.

e. Schedule Drawings: Provide load schedules noting source and destination of wiring and associated connected load.

f. Labeling Drawing: Provide representative equipment and cabling labeling scheme. Include font sizes and styles, explanation of scheme, and descriptor and designator schedule.

g. General Detail Drawings: Provide detail drawings depicting any unique installation methods specific to each product.

h. Control Screen Templates: Provide layout drawings and/or screenshots for master house lighting stations and similar electronic control surfaces.

04 Any other pertinent data generated which is necessary to provide the Work.

F. Submittal Format:

01 Electronic (PDF) submittal documents are required for review.

02 Provide each submittal with a unique number and each shall be numbered in consecutive order.

03 Submittals shall not be issued with other disciplines.

04 Provide each submittal with a complete table of contents with the following information:

   a. Project Name
   b. Submittal number. In the case of a resubmittal, use the original submittal number immediately followed by the suffix “R” immediately followed by a unique number and shall be numbered in consecutive order.
   c. Date of submission.
   d. Referenced specification Section, Part, Article, Paragraph, and page number or drawing reference as applicable.

05 Follow list by Manufacturer’s data sheets, arranged as in Part 2 of this specification. If a data sheet shows more than one product, indicate the model being proposed with an arrow or other appropriate symbol.

06 Drawings executed at an appropriate scale, but not smaller than 1/8" = 1'-0”.

G. Resubmission Requirements:

01 Make any requested corrections or change in submittals required. Resubmit for review as directed.

02 Indicate any changes that have been made other than those requested.

03 Approval of Submittals: Each submittal package will be returned with one of the following stamps:

   a. “No Exceptions Taken” proceed with construction; all job site coordination will be at the direction of the General Contractor.

b. "Make Corrections Noted: No Resubmission Required" submittals have been returned with conditional approval. Corrections, as indicated on the returned drawings and/or specifications, must be made before construction can begin.

c. "Make Corrections Noted: Submit Only Corrected Pages/Items" submittals have been returned with conditional approval. Corrections, as indicated on the returned drawings and/or specifications, must be made in writing and returned to the consultant before construction can begin.

d. "REJECTED, Submit Specified Item" a specified item in the submittal has been rejected for the reasons noted. Re-submit in compliance with the specifications.

e. "REJECTED, Revise and Re-submit" submittal has been rejected for the reasons noted. Re-submit in compliance with the specifications.

f. "No Review Action Required" all information provided was for information or coordination purposes only. Review is not required.

04 Any of the above stamps may also carry a "PARTIAL" stamp. This indicates that required information noted in the section above was not provided. Omitted items may be noted as part of the reviewed submittal, but it is the Contractor's responsibility to verify all required submittal documentation.

1.10 PROJECT RECORD MANUAL

A. Provide electronic copies of the project record documents or as required per the General Conditions of the Project.

B. The Project Record Manual shall be segregated into three separate bindings as follows:

01 As-Built Record Documents:

a. Product Data:

1. List of all products incorporated in the Project inclusive of all substitutions, field changes, or revisions The list shall include Manufacturer's serial numbers.
2. Manufacturer's data for each type of product conforming to the scheme above.
3. Organize and bind the above in specification order.

b. Record drawings: Final rendition of project drawings enumerated in the Submittal section above. Provide editable computer software generated drawings using standard industry graphic standards. Hand or poorly drawn documents will not be accepted. All drawings shall be created on a computer aided drafting (CAD) system, in both a DWG and PDF file format.

c. Test Reports: Record findings of systems testing described in Part 3 below.

02 Operations Manual

a. System Operation and Instructions: Prepare a complete and typical procedure for the operation of the equipment as a system, organized by subsystem or activity.

1. This procedure should describe the operation of all system capabilities.
2. Assume the intended reader of the manual to be technically experienced but unfamiliar with the components and the facility.

03 Service & Maintenance Manual:

a. Provide an original copy of the service manual on every piece of equipment for which the Manufacturer offers a service manual. Arrange manuals in the same order as the operations manual.
b. Manufacturer's maintenance and care instructions.
c. Maintenance Instructions: include maintenance phone number(s) and hours, maintenance schedule, description of products recommended or provided for maintenance purposes, and instructions for the proper use of these products.

04 Warranty Manual:

a. Manufacturer's warranty statements on each product.
b. Date of substantial completion and ending dates for warranties for each group of products.
c. Software registration and licenses.

05 Include any other pertinent data generated during the Project or required for future service.

06 Appropriately duplicate data within the separate bindings when it will reasonably clarify procedures, e.g., operational data in maintenance binding.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Products shall ship and be stored in their original container to prevent damaging or entrance of foreign matter.

B. Provide protective covering during construction to prevent damaging or entrance of foreign matter.

C. Replace, at no expense to Owner, product damaged during storage, handling, or the course of construction.

1.12 PROJECT CONDITIONS

A. Verify conditions on the job site applicable to this work. Notify Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.

B. The Drawings diagrammatically show cabling and arrangements of equipment fitting the space available without interference. If conditions exist which make it impossible to install work as shown, recommend solutions and/or submit drawings to the Architect for approval, showing how the work may be installed.

1.13 FINAL TESTING AND OBSERVATION

A. Upon completion of installation and initial tests and adjustments specified in Part 3, acceptance testing shall be performed by the Consultant.

B. The process of acceptance testing the System may necessitate moving and adjusting certain component parts; perform such adjustments without claim for additional payment.

1.14 WARRANTY

A. Warrant labor and product for two (2) years following the date of substantial completion to be free of defects and deficiencies and to conform to the drawings and specifications as to kind, quality, function, and characteristics. Repair or replace defects occurring in labor or product within the Warranty period without charge. Any cost associated with this warranty repair is the responsibility of the Contractor.

B. This warranty is in addition to any specific warranties issued by Manufacturers for greater periods of time.

C. Within the warranty period, answer service calls within twenty-four (24) hours during normal working hours and correct the deficiency within forty-eight (48) hours.

D. During the warranty period, the Manufacturer shall provide a toll-free 24-hour-per-day number for telephone technical support and service request. If callback is required, calls shall be answered within thirty (30) minutes.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Model numbers and manufacturers included in this specification are listed to establish a standard of product function, performance, and quality. Products or manufacturers listed herein are listed in no particular order or preference.

B. Refer to General and Supplementary Conditions and Division 1 Specification Sections for equipment substitution procedure. Substitution of any equipment within this specification shall require review and approval by WJHW.

C. Providing product not specifically specified without prior written approval by the Owner, Architect, and/or Architect's Consultant shall not be accepted.

2.2 GENERAL

A. Products shall be new, free from defects and listed by an NRTL when an applicable NRTL Standard exists. Provide product of a given type from one manufacturer.

B. Provide product of a given type from one manufacturer.

C. Regardless of the length or completeness of the descriptive paragraph herein, provide product complying with the specified manufacturers' published specifications.

2.3 CABLING AND ACCESSORIES

A. All cable shall be compliant with NEC and NRTL listed. Any NRTL listing must be available at the time of bid.

B. All electrical conductors installed under this contract, except where otherwise specified, shall be soft drawn annealed stranded copper having a conductivity of not less than 98% of pure copper, and meet appropriate ratings (e.g., CMR, CMP, etc.)

C. Cable shall carry appropriate fire rating (e.g., CMR, CMP, OFNR, OFNP, etc.) on jacket of cable.

D. Where cables are routed through cable tray, provide tray rated cable of equal specification.

E. Where cables are run exposed through a return air plenum, provide plenum rated cable of equal specification.

F. Shielded cables located in raceways shall have aluminum foil shield with drain wire.

G. The Belden cables listed below are approved for use on this project and are listed to set the acceptable standard of performance. If field conditions or actual cable pathway requires tray or plenum cable, provide version of cable that meets required rating. Cables from Carol, Liberty, and West Penn are also acceptable provided they meet the performance specifications of the approved listed cables.

H. DMX512 (E-DMX) distribution cable:
   01 Provide 24 AWG four twisted pair data cable.
   02 Pair Color Code Chart:

      a. 1 – White/Blue Stripe and Blue
      b. 2 – White/Orange Stripe and Orange
      c. 3 – White/Green Stripe and Green
      d. 4 – White/Brown Stripe and Brown

   03 Insulation: Polyolefin
   04 Inner/Outer Jacket Material: PVC – Polyvinyl Chloride
   05 Nominal Impedance: 100 ohms.
   06 Nominal Velocity of Prop.: 72%
   07 Capacitance between conductors: 15.0 pF/ft.
   08 Acceptable product:

      a. Belden 1583A (Category 5E).

I. DMX512 (E-DMX) distribution cable – Stage Electric Drops:
   01 Provide extra rugged, flexible control cable (Ethernet) for connection of NET outlets on grid to electric batten distribution.
   02 Cable to be four-pair, double shielded, low-capacitance.
   03 Conductors: 26 AWG tinned, annealed copper stranded 7 x 0.16.
   04 Connector: Provide with EtherCon connector by Neutrik®.
   05 Assembly: pairs cabled with Kevlar strength member.
   06 Shield: (inner) aluminum/Mylar, 100% coverage (outer) tinned copper braid, 80% coverage.
   07 Conductivity: 15ohms per 100 meters @ 20C.
   08 Impedance: 100 ± 15 ohms 1-100MHz.
   09 Acceptable product:

      a. TMB & Associates ProPlex or equivalent.

J. DMX512 Backup Control Signal Distribution Cable:
   01 Provide 24 AWG two twisted pair cable.
   02 Insulation: Foam polyethylene.
   03 Shield: aluminum foil/polyester tape.
   04 Capacitance between conductors: 12.5 pF/ft.
   05 Acceptable product:

      a. Belden 9729

K. Architectural Lighting DMX Cable:
   01 Provide 24 AWG two twisted pair cable.
   02 Insulation: Foam polyethylene.
   03 Shield: aluminum foil/polyester tape.
   04 Capacitance between conductors: 12.5 pF/ft.
   05 Acceptable product:

      a. Belden 9842

L. Preset Station Signal Distribution Cable:
   01 Provide 16 AWG single twisted pair cable.
   02 Insulation: PVC-polyvinyl chloride.
   03 Shield: unshielded.
   04 Capacitance between conductors: 33 pF/ft.
   05 Acceptable product:

a. Belden 8471

M. Multi-Conductor SO Type Cable:
01 Provide multi-conductor cable with black neoprene jacket.
02 Conductivity: not less than 98%.
03 Conductor: soft drawn annealed stranded copper.
04 Minimum Conductor Temperature: 90° C.
05 Size: No. 12 AWG minimum.
06 No. of Conductors: As required by circuits shown.
07 Acceptable product:

a. Cole Wire & Cable
b. Carol
c. Rome

2.4 POWER DISTRIBUTION

A. Wall-Mounted Motorized Breaker Panels (MBP)

01 General

a. Breaker Panels shall be UL Listed,
b. Breaker Panels shall consist of a main enclosure with 12, 24, or 48 pole breaker subpanels, integral control electronics for low voltage terminations and provision for accessory cards
c. The panel shall be constructed of 16-gauge galvanized steel. All panel components shall be properly treated or finished in fine-textured, scratch resistant paint
d. The unit shall provide interior cover over the control electronics and accessory cards to allow access only to class 2 wiring and prevent direct access to class 1 line voltage components
e. Circuits as described in schedule
f. Breakers shall provide manual switching control while power is unavailable

02 Each panel shall have a keypad and LCD display for rack configuration, backup, and fault indication.
03 Panels shall employ USITT DMX-512 control format.
04 An Ethernet connection shall provide advanced control of relays over streaming ACN (sACN) and transmit status, control override, and measured energy usage per branch circuit via an internal Web UI or central monitoring interface
05 The panel shall have a UL924-listed contact input for use in Emergency Lighting systems.
06 Electrical

a. Breaker Panels shall be available to support power input from:
1. 120/208V three phase 4-wire plus ground
b. Breaker panels shall support main circuit breaker options:
c. As required for functional system based on existing electrical service or Division 26 documents

07 Breaker Panel Accessories

a. A low voltage 0-10V dimming option shall provide up to 24 0-10v control outputs that are linked to relay circuits within the panel. Each output shall support up to 400mA of current sink per output
b. A contact input option shall provide 24 dry contact inputs to be linked for direct or group relay control, to activate a preset, or to activate a sequence. Controller software shall allow for normally open maintained, normally closed maintained, or momentary toggle

08 Provide with main disconnect breaker option.

09 Quantity: As shown in drawings
10 Acceptable Product

a. Lyntec - LCP Series Lighting Control Panelboards
b. Vari-Lite – RigSwitch+ Panel
c. Electronic Theatre Controls – Sensor IQ Panel

B. Distribution Wiring Devices

01 General

a. All power distribution devices overall assembly shall be listed by a nationally recognized test lab.
b. All dimmed circuit connectors shall be 20A grounded stage pin type. All switched circuits connectors shall be 20A twistlock type. All connector types provided shall be of a single manufacture.
c. All pigtails shall be three-wire type “SOW” rubber jackets cable. All pigtails to be provided with proper strain relief.
d. All power distribution devices shall be fabricated from minimum 18-gauge galvanized steel and finished in black fine-textured powder coat paint unless noted otherwise. Boxes shall be free from burrs, sharp corner, and overhanging edges.
e. Circuits for Raceways and Plugging Boxes shall be labelled with 2” yellow on black Brady numbers. Numbers shall be located so that they are not obscured by cabling. Circuits shall be assigned and labelled per schedules on drawings
f. Circuits for Wall Boxes and Floor Pockets shall be labelled with 1” yellow on black Brady numbers. Numbers shall be located so that they are not obscured by cabling. Circuits shall be assigned and labelled per schedules on drawings. As a rule, circuits shall number Stage Left to Stage Right, Down stage to Upstage.
g. All power distribution devices shall be provided with appropriate mounting hardware.
h. All multi-conductor cable is to be provided with Kellems-type strain relief grips at each end of the cables with intermediate strain relief as required.
i. Provide connector strips, gridiron junction boxes (GIJB), and associated hardware for over the stage lighting. Coordinate connector strip lengths for electrics with the theatrical rigging equipment. Provide all multi-conductor cables allowing the devices to fly to a low trim as indicated on the TR sheets. The cable is to be provided with necessary cable strain relief grips as part of the cable management system. Provide rugged network control cables to parallel the multi-conductor cable runs. Verify all electrical circuits and label all circuit numbers as specified.

02 Wall Mounted Boxes (WB)

a. Provide a wall plug-box designed for recessed mounting.
b. Construction: code gauge steel.
c. Connectors: female 20 Ampere twistlock-type connectors surface mounted in the plug-box.
d. Circuits: number of circuits as specified on drawings.
e. Labeling: circuits are labeled with yellow letters on black background.
f. Overall assembly UL listed.
g. Quantity: As shown in drawings.
h. Acceptable product:
    1. Altman 450 series
    2. ETC 9200 series
    3. SSRC RM series

03 Pipe Mounted Boxes (PB)

a. Provide a plug box designed for pipe mounting.
b. Construction: code gauge steel.
c. Pigtails: SO type cable. Provide lengths as shown on drawings.
d. Connectors: female 20A twistlock connectors on the end of each of the pigtails and flush mounted 20A parallel blade receptacles for convenience circuits.
e. Circuits: number of circuits as specified on drawings.
f. Labeling: circuits are labeled with yellow letters on black background.
g. Overall assembly UL listed.
h. Quantity: As shown in drawings.
i. Acceptable product:
    1. Altman 450 series
    2. ETC 9300 series
    3. SSRC PM series

2.5 CONTROL EQUIPMENT

A. UPS Backup Power / Surge Protection

01 Provide a rack mountable UPS backup to support equipment located in the control distribution racks (provide with one (1) spare battery).
02 Output Power Capacity: 1400VA/1050W
03 Input 120V/ Output 120V
04 Interface Port: DB-9 RS-232
05 Extended runtime model
06 Rack Height: 2 Units
07 Filtering: Full time multi-pole noise - filtering: 0.3% IEEE surge let-through: zero clamping response time: meets UL 1449
08 The UPS shall be provided by the lighting control system manufacturer.
09 Quantity: As shown in drawings.
10 Acceptable product:

a. APC
b. Tripp Lite
c. Middle Atlantic

B. Control Components

01 Ethernet Switches (ESW)

a. Provide business grade Gigabit PoE+, Layer 2 managed Ethernet switches in the AV Rack as shown in the TL series documents.
b. Switch shall include 24 POE+ ports meeting IEEE802.3at standard
c. Switch shall include port routing via separate VLAN subnets
d. Switch shall be equipped with LED indicators for power status, port status, bandwidth utilization, collision detection and speed indication.
e. Switch shall have a built-in web-based management interface to provide easy to use management through a standard browser. Provide with all required software management tools.
f. Provide rack mount kit and required hardware and cables for stacking.
g. Each network location shall have a dedicated input point on the network switch. Dedicated input points shall be clearly labeled to identify connected network device at the patch panel. Patching shall not be required.
h. Ethernet switch shall be tested and approved by Lighting Control System Manufacturer for compatibility with all connected devices.
i. Quantity: As required by design

02 Network Node/Gateway

a. Provide rack-mounted DMX Ethernet node/Gateway to generate DMX to devices located at theatrical and house architectural lighting positions
b. Nodes shall have (4) screw terminal or 5-pin DMX connectors for a total of 4 DMX universes for distribution over the Ethernet system.
c. DMX Node shall have LEDs for indication of power, network activity, and DMX port configuration.
d. Each input shall route directly to the Ethernet Switch located in the assigned Dimmer Rooms without the need for patching.
e. Quantity: As required by design.
f. Acceptable product:
    1. Pathway rack or DIN rail mounted gateway
    2. Vari-Lite rack or DIN rail mounted gateway
    3. ETC rack or DIN rail mounted gateway

C. Plates and Devices

01 Network Receptacle Station/Gateway (NET)

a. Provide a remote plug-in station for connection of control console and portable DMX Gateways at control booth and other locations as noted in the drawings.
b. Station shall be provided with a Neutrik RJ45 jack. Each jack shall be rated for use in harsh commercial conditions.
c. Station will contain the following components:
    1. RJ 45 jack with punch down block, provide Neutrik EtherCon type receptacle as indicated on drawings.
    2. Station faceplates shall be .80” aluminum, finished in fine texture, scratch-resistant black powder coat.
    3. Station back box will be a minimum of 2.5 inches.
    4. Station shall have silk screened graphics white in color.
    5. Provide a Lamacoid label that de-notes, using an alpha-numeric labeling convention, the switch location and network port number.
d. These network connections shall also be configured with a back box and mounting hardware for mounting on the FOH lighting galleries or backstage.
e. Each Network jack will route directly to the Ethernet Switch located in the assigned Dimmer Rooms without the need for patching.
f. No daisy chaining between jacks or splicing of Category 5e and above cable is allowed.
g. Quantity: As shown in drawings.
h. Acceptable product:
    1. Pathway Network station
    2. Vari-Lite station
    3. SSRC station
    4. ETC Network station

02 DMX512 Distribution (DMX):

a. Provide DMX512 distribution for connection to wiring devices in the Classroom and Auditorium.
b. Modules shall provide one optically isolated DMX512 signal output capable of driving thirty-two (32) receiving devices on a single DMX line.
c. Provide a wall plugging box designed for surface mounting.
d. Construction: code gauge steel.
e. Connectors: Neutrik 5 conductor XLR, flush mounted.
f. Circuits: located as shown on the drawings.

g. Labeling: labeled with yellow letters on black background.
h. Quantity: As shown in drawings.
i. Acceptable product:
1. Pathway Connectivity station
2. Vari-Lite station
3. SSRC station
4. ETC station

03 Control Receptacle Station (CR#)

a. Provide a flush-mounted control station for connection of the control console over network.
1. Provide with DMX Output receptacles as scheduled.
b. Station will contain receptacle components as described on the drawings.
c. Station faceplates shall be .80” aluminum, finished in fine texture, scratch resistant black powder coat.
d. Station Back box will be a minimum of 2.5 inches deep
e. Station shall have white, silk screened graphics
f. Provide a Lamacoid label for network jacks that denotes, using alpha-numeric labelling convention, the switch location and network port number.
g. Each network jack shall route directly to the Ethernet switch without the need for patching.
h. No daisy-chaining between jacks or splicing on network cabling is allowed.
i. Quantity: As shown in drawings.
j. Acceptable product:
1. Pathway Connectivity station
2. Vari-Lite station
3. SSRC station
4. ETC station

2.6 CONTROL CONSOLE AND ACCESSORIES

A. Overview

01 Provide a control console for direct operation of theatrical fixtures and development of user-presets to be stored for recall via the Architectural Control Sub-system specified in this section.
02 Provide initial setup as directed as part of the system commissioning process.

B. Control Console

01 The lighting control console shall be a microprocessor-based system specifically designed to provide complete control of stage, studio, and entertainment lighting systems.
02 The system shall also be able to control third party ACN devices directly. The system shall provide control of 1,024 or 6,144 outputs on a maximum of 32,768 control channels.
03 A maximum of 10,000 cues, 999 cue lists, 1000 groups, 1000 presets, 4 x 1000 palettes (Intensity, Focus, Color and Beam), 1000 effects, 1000 macros and 100 curves may be contained in non-volatile electronic memory and stored to an onboard hard disk or to any USB storage device.
04 The console may be placed in Tracking or Cue Only mode by the user as a system default and overridden on individual record actions as required.
05 A Master Playback fader pair and dedicated Grand Master/Blackout shall be provided.
06 A high-resolution level wheel shall be provided to control intensity for selected channels and scrolling within selected displays. Four page-able high-resolution encoders shall be provided for control of other non-intensity parameters. Non-

intensity parameters shall be controllable via the encoders or keypad controls, without need of an external pointing device.

07 Control and programming features for automated fixtures shall also include: a standard library of fixture profiles, the ability to copy and edit existing profiles and create new profiles, patch displays including channel and output addressing, 16-bit fade resolution, color characterization allowing color mixing and storing in Hue and Saturation or native device values.

08 The system shall direct user input through on-screen dynamic prompts and integral LEDs on console keys indicating current operating mode. A context sensitive on-line Help feature shall explain and provide an example of the operation of each feature of the system.

09 A row of softkeys shall be provided, which change function based on the selection and context of the console. These softkeys shall be labeled via an adjacent LCD display that shows their current functions at all times. Systems using softkeys with no LCD display shall not be acceptable.

10 Console software upgrades shall be made by the user via a USB port; changing internal components shall not be required.

11 The console operating software shall be loaded into program execution memory from the internal hard drive when the console is powered. In the event of an uncontrolled shutdown, the console shall return to its last output state when power is restored.

12 Console power shall be 95 – 240V AC at 50 or 60Hz, supplied via a detachable power cord.

13 Accessories:

a. Provide (2) external touchscreens high resolution DVI monitors that will display system information, including playback status, live output and blind values for all record targets.
b. Provide (1) fully-functioning, detachable alphanumeric keyboard. The keyboard shall allow labeling of channels, cues, presets, groups, palettes, effects, macros, curves and the show. An integral electronic keyboard shall be provided.
c. Provide with dust cover
d. Provide with USB mouse
e. Provide with 25’ network control cable
f. Provide (1) Littlite with 3-pin XLR connector
g. Provide (1) USB jump drive, minimum 8gb

14 Quantity: (1)

15 Acceptable product:

a. Electronic Theater Controls Element 2 with 6,144 channels of control

2.7 ARCHITECTURAL CONTROL SYSTEM

A. Processing – Provide either a rack mounted control processor located in the AV rack or provide distributed processing at each control station.

01 The processing rack shall receive output data from a lighting control console and/or architectural control stations, process the information it receives and distribute the information to DMX-controlled panels and devices.

02 Processing Racks shall be designed to support the following wire terminations:

a. AC (single phase)
b. Echelon link power
c. 24Vdc
d. DMX512 In
e. DMX512 Out
f. RS232 Serial In/Out

g. Net3 Unshielded Twisted Pair (UTP) or ST fiber optic

03 Coordinate integration of audio-visual system with contractor and program system as directed by the End User.

B. Configuration – Configure architectural control system screens in conjunction with User prior to commissioning. Base configuration shall accommodate the following basic layouts:

01 Main Navigation
02 User configurable named presets (2 pages to be programmed at training)
03 Work light individual control
04 Work light presets
05 Running lights presets

C. Stations - General

01 Master stations shall be located in the control booth, backstage and as noted on the contract documents.
02 Provide preset stations as described below and shown in drawings.
03 All audience exposed switches shall be provided with locking covers and shall be painted a custom color as determined by the architect.

D. Acceptable product:

01 Electronic Theatre Controls Paradigm System with Ern
02 Vari-Lite Vision.net
03 Interactive Technologies CueServer3 Pro

E. Control Stations/Receptacles

01 House Light Master Station (HLM)

a. Provide full color 7” LCD touchscreen master station.
b. Station shall be wall mounted or rack mounted as shown on drawings
c. Station finish shall be black in technical areas and color selected by Architect for public spaces.
d. Station shall be configurable with system software via USB, serial data and Network interface
e. Station shall have the ability to store multiple configurations with the User being able to select which is active.
f. Station shall accommodate individual zone control, preset record and selection function.
g. Station shall be able to lock out preset stations located in the facility.
h. Master station shall have local control for each work light, house lights, running lights and other settings as required by the Owner.
i. Quantity: As shown on the drawings.
j. Acceptable product:
1. Electronic Theatre Controls – Unison Paradigm touchscreen station
2. Vari-Lite – Vision.net touchscreen station
3. Interactive Technologies – CueServer3 Pro Insite touchscreen station

02 Push Button Preset Stations (HL5)

a. Provide two, five and ten push button stations as shown on drawings

b. Stations shall be mounted within a one-gang back box
c. Station finish shall be black in technical areas color selected by Architect for public spaces.
d. Two button stations (HL2) shall be programmed for on/off operation with on button being a fully programmable preset
e. Five button stations (HL5) shall have four programmable presets plus off. Presets may include house lights, work lights, blue lighting and will be programmed with the User.
f. Quantity: As shown on the drawings.
g. Acceptable product:
1. Electronic Theatre Control Unison Heritage
2. Vari-Lite Vision.net
3. Interactive Technologies Ultra Stations

2.8 MISCELLANEOUS

A. Type 'WS' – Running Lights
01 Provide any and all required drivers to interface with the theatrical lighting control system.
02 Housing: Black unless noted by Architect.
03 Coordinate installation with Electrical.
04 Overall assembly is to be UL listed.
05 Installation: Field verify dimensions before installation. Coordinate with Electrical contractor and Theater Consultant. Lighting calculation and exact locations to be reviewed by Electrical Engineer and Theater Consultant before final installation.
06 Provide with necessary leader cables, power supplies, transformers, and mounting hardware, etc.
07 Provide time (assume two [2] hours minimum) for final DMX control programming with Theater Consultant or Architect at closeout of project.
08 Quantity: As shown on the drawings
09 Approved Product:
a. ETC BlueBeam – BSDBF with BSEL Eyelid accessory
b. Or approved equal

2.9 PORTABLE LIGHTING FIXTURES AND ACCESSORIES

A. Provide and integrate the following equipment into the project.

01 Theatrical Lighting Fixtures

a. The portable lighting fixtures shall connect and be controlled by the new theatrical lighting control system.
b. All fixtures shall be listed by UL or an OSHA approved NRTL.
c. Fixtures shall be constructed of rugged die cast aluminum with high impact knobs and handles unless otherwise noted.
d. Fixtures shall be provided with a black finish unless otherwise noted.
e. Fixtures shall have a rugged steel yoke with a positive locking clutch which will allow for a 300º body rotation.
f. All fixtures shall be provided with color frame, power lead with mating grounded connector, safety cable, and c-clamp.
g. Fixtures shall be:
1. Labeled with the Owner's mark and select numbering/labelling inventory scheme.
2. Bench-focused, if necessary.
3. Hung in the Owner's selected stock plot.
4. Patched at the console.

B. LED-type fixtures

01 Provide (1) C-Clamp, (1) power pass-through and (1) DMX extension cable at 5 ft. length for each LED-type fixture included in the inventory. All cables shall adhere to requirements set for below in Cables and Accessories portion of this specification.

02 All LED-type fixtures shall support ANSI E1.11 DMX512-A and ANSI E1.20 RDM standards.

03 All LEDs used in the product shall be high brightness and proven quality from established and reputable LED manufacturers.

04 Manufacturer of LED emitters shall utilize an advanced production LED binning process to maintain color consistency.

C. Fixtures – Type and Quantity

01 Type 1 – Color-changing LED Zoom-style Profile

a. Provide an RGBL color mixing high-intensity LED illuminator with DMX controlled intensity and color;
b. Unit shall have a shutter assembly with (4) blades mounted in two or more planes. Shutter blades shall be warp and burnout resistant;
c. Unit shall have two accessory slots, a top-mounted quick release gel frame retainer, and a slot with sliding cover for motorized pattern devices or optional iris.
d. Unit shall have projector-like quality pattern imaging, sharp shutter cuts without halation, and allow for both hard and soft beam edges;
e. Unit shall operate at 100V to 240V 50/60 Hz and utilize an internal power supply;
f. Provide power lead with twistlock connector;
g. Unit shall support power and DMX in and thru connections;
h. Unit shall utilize an integral 25º -50º adjustable lens assembly;
i. Unit shall have top-mounted quick release gel frame retainer;
j. Quantity: (36)
k. Acceptable product:
1. ETC ColorSource Spot jr Deep Blue
2. Vari-Lite Acclaim LED Zoomspot
3. Chauvet Ovation E2-FC

02 Type 2 – Color-changing LED Wash

a. Provide an RGBL color mixing high-intensity LED illuminator with DMX controlled intensity and color;
b. Unit shall have an accessory slot with a top-mounted quick release gel frame retainer.
c. Unit shall operate at 100V to 240V 50/60 Hz and utilize an internal power supply.
d. Provide power lead with twistlock connector;
e. Unit shall support power and DMX in and thru connections.
f. Provide with (6) barn door assemblies and floor-stand yokes with base.
g. Quantity:
1. Black Box: (20)
h. Acceptable product:
1. ETC ColorSource Fresnel V
2. Vari-Lite Acclaim LED Fresnel
3. Chauvet Ovation P-56FC

D. Cables and Accessories

01 Extension Cables:

a. Provide extension cables for extending pigtail or wall box circuits to lighting instrument.
b. Provide cable and connectors which meet or exceed the quality of cables and connectors set forth in this specification.
c. Provide each cable with Velcro cable tie.
d. Provide extension cable assemblies consisting of 12-gauge, 3 conductor flexible cable and 20A rated male and female grounded twist-lock connectors.
e. Quantity:
    a) (8) @ 10 ft.
    b) (8) @ 25 ft.
    c) (4) @ 50 ft.
f. Acceptable Products:
    1. TMB & Associates ProPower
    2. Lex Products PowerFLEX
    3. Or approved equal

02 Adapter Cables

a. Provide adapter cables for extending pigtail or wall box circuits to lighting instrument.
b. Provide cable and connectors which meet or exceed the quality of cables and connectors set forth in this specification.
c. Provide each cable with Velcro cable tie.
d. Provide extension cable assemblies consisting of 12-gauge, 3 conductor flexible cable and 20A rated male Edison connectors and female grounded twist-lock connectors.
e. Quantity:
    1. (6) @ 1ft. with Male Edison and female twist-lock connectors
    2. (6) @ 1ft. with Male twist-lock and female Edison connectors
f. Acceptable Products:
    1. TMB & Associates ProPower
    2. Lex Products PowerFLEX
    3. Or approved equal

03 Two-fers:

a. Provide “Y” cables to connect two fixtures to a single receptacle.
b. Provide cable and connectors, which meet or exceed the quality of cables and connectors set forth in this specification.
c. Provide adapter assemblies consisting of 12-gauge, 3 conductor flexible cable and connectors of same specifications found in this section.
d. Quantity: (6)
e. Acceptable Products:
    1. TMB & Associates ProPower
    2. Lex Products PowerFLEX
    3. Or approved equal

04 DMX-512 cable

a. Provide DMX-512 cables for connecting lighting consoles, moving lights, or other DMX controlled accessories to the Network Nodes.
b. Connectors shall be Neutrik 5-pin.
c. Provide 24AWG two twisted pair data cable.
d. Insulation: polyethylene.
e. Nominal Impedance: 100 ohms.
f. Nominal Velocity of Prop.: 78%.
g. Capacitance between conductors: 12.5 pF/ft.
h. Quantity:

a) (8) 10’ DMX Cable
b) (8) 25’ DMX Cable
c) (4) 50’ DMX Cable

i. Acceptable Products:
1. TMB & Associates ProPlex
2. Lex Products PowerFLEX
3. Or approved equal

05 Flexible Category 5e Cable/NET Cable:

a. Provide extra rugged, flexible control cable (Ethernet) for connection of NET stations to portable Network Nodes.
b. Cable to be 4-pair, double shielded, low-capacitance.
c. Conductors: 24 AWG tinned, annealed copper stranded 7 x 0.16.
d. Connector: Provide with EtherCon connector by Neutrik
e. Assembly: pairs cabled with Kevlar strength member.
f. Shield: (inner) aluminum/Mylar, 100% coverage (outer) tinned copper braid, 80% coverage.
g. Conductivity: 15ohms per 100 meters @ 20C.
h. Impedance: 100 ±15 ohms 1-100 MHz
i. Quantity:
1. (4) 3’ Ethernet Cable
2. (4) 10’ Ethernet Cable
3. (2) 25’ Ethernet Cable
j. Acceptable Products:
1. TMB & Associates ProPlex
2. Lex Products PowerFLEX
3. Or approved equal

06 XLR DMX Terminator

a. Provide XLR DMX male terminator
b. Connector shall be Neutrik 5-pin.
c. Termination resistance: 120 ohms +/- 10% between pins 2 and 3
d. Termination power capacity: 2 watts
e. Quantity: (8)
f. Acceptable Product
1. ETC SGE 1507
2. Lex Products DMX5P-TERM

07 Color Medium Sheets

a. Provide standard and high temperature (HT) color medium
b. Color medium shall be selected by Owner
c. Provide (10) full size sheets (20”x24”) of HT color filter
d. Acceptable product:
1. Lee Color Filters
2. Rosco Color Filters

08 Tie Line

a. Product will be a cotton line with polyester core
b. The blend will be a diamond braid construction
c. Product will be Black in color
d. Product will be unglazed
e. Product will be 1/8” in diameter
f. Product will be on original spool or reel
g. Provide 600’-0” spool
1. Cut into 24” ties for dressing cable used in repertory plot
2. Furnish the remainder of unused spool to Owner

h. Acceptable product:
1. Rose Brand #4 Tie Line

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate incorporation of the Work specified herein with other project work so as to facilitate a cohesive final product.

B. The installation recommendations contained within the Telecommunications Distribution Methods Manual are mandatory minimum standards and requirements.

C. Mount equipment and enclosures plumb and level.

D. Permanently installed equipment to be firmly and safely held in place.

E. Verify all locations of equipment in all rooms with Owner's Representative, Owner, and Consultant.

3.2 INSTALLATION OF CABLE AND WIRING

A. Verify installation of electrical work for this scope and all associated equipment with the overall Electrical installation. Provide all necessary equipment, including mounting hardware, for complete connection of power system wiring.

B. Verify installation of power and ground wiring to equipment. Power and ground wiring will terminate inside of equipment and/or junction boxes and be hardwired to ground buss and circuit breaker to ensure uninterrupted operation.

C. All control wiring will be executed in adherence to ANSI standards including the following:
01 Isolate cables carrying signals at different levels and separate to restrict interaction.
02 Keep wiring separated into three groups of conduit provided for control circuits, power circuits (up to 50 Amps), and feeder circuits (above 50 Amps).
03 Isolate all wiring, except for safety ground wiring, from conduit ground.
04 Take such precautions as are necessary to prevent and guard against electromagnetic and electrostatic interference in other technical systems (such as sound and communications systems) in the facility. Where possible all devices and wiring will be enclosed in a shielded environment. Take care not to use shields (conduits) and grounds as current carrying return paths for lamp and relay coil commons. All ground references are to be made to the building electrical system ground.
05 Label unused wiring provided for spares or future systems and terminate at screw terminal strips.
06 All joints and connections will be made with resin-core solder or with ratchet jaw crimp type mechanical connectors. Connect all circuits electrically in phase using same wire color code for similar circuits throughout the project.
07 Install cable in a manner to adhere to manufacturer's specifications for maximum cable pulling tension, minimum bend radius, and restrictions.
08 Provide appropriate support at all horizontal-to-vertical transitions in order to keep the weight of the cable from degrading at the point of transition.
09 If a J-hook or trapeze system is used to support cable bundles, all horizontal cables shall be supported at a maximum of 48-inch (1.2 meter) intervals. At no point shall the cables rest on light fixtures, acoustic ceiling grids, panels, conduits, sprinkler pipe, water pipe and/or HVAC system ducting.
10 Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support

hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices

11 Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, install appropriate carriers to support the cabling.

12 Cables shall be identified by a self-adhesive machine label in accordance with the System Documentation Section of this specification and ANSI/TIA/EIA-606-A. The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate.

13 Unshielded twisted pair cable shall be installed so that there are no bends smaller than four times the cable outside diameter at any point in the run and at the termination field.

14 Provide splice free wiring and cabling from origination to destination. Cables shall be installed in continuous lengths from origin to destination (no splices). Properly designed transition points, or consolidation points are not considered 'splice' points.

15 Cover edges of cable and wire pass-through holes in chassis, housings, boxes, etc., with rubber grommets or Brady GRNY nylon grommetting.

16 Any cable damaged or exceeding recommended installation parameters during installation shall be replaced prior to final acceptance at no cost to the Owner.

3.3 INSTALLATION OF EQUIPMENT

A. Take appropriate precautions against electrostatic discharge (ESD) when installing electronic equipment.

B. Equipment to be installed in new condition, free of damages, scratches, dents, etc.

C. Provide adequate ventilation in cabinet mounted equipment to maintain operating temperatures within range recommended by Manufacturer.

D. All equipment will be installed in compliance with applicable Local and National Codes and Regulations.

E. Equipment shall be installed in accordance with Manufacturer's requirements.

F. Install lighting fixtures using standard industry practices. All lamps, lenses, and reflectors will be installed free of dirt, dust, and finger smudges. Do not use bare hands when handling conventional tungsten lamps. Ensure that a safety cable is properly applied with each fixture.

G. Install lighting instruments to the standard house hang or repertory plot as directed by Consultant. Contractor shall document location of each type of distribution device and circuiting as part of as-built documents on plot. Provide pdf copy of plot to Consultant and Owner. Provide (2) full size printed copies of plot to Owner.

3.4 CONTRACTOR COMMISSIONING

A. Prior to energizing or testing the System ensure the following:

01 Physical installation is complete.

02 Products are installed in proper and safe manner according to Manufacturer's requirements.

03 Dust, debris, solder splatter, etc. is removed.

04 Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.

05 Temporary facilities and utilities have been properly disconnected and removed.

06 Broken work, including glass, raised flooring and supports, ceiling tiles and supports, walls, doors, etc. have been replaced or properly repaired, and debris cleaned up and discarded. The jobsite shall be broom clean.

B. Contractor shall:
01 Retain the services of a Manufacturer certified technician to check the installation and ensure its proper operation. No part of the Theatrical Lighting System may be energized before this technician has checked and approved the System installation.
02 Test all lighting load circuits for the following:

a. Continuity
b. Nominal voltage
c. Polarity
d. Accuracy to the Distribution Schedule as enumerated in the drawings.

03 Test controls wiring for the following:

a. Appropriate wire types and quantities
b. Control wire distance from source
c. Terminations meet Manufacturer requirements

C. The following identifies some, but not all, of the commissioning tasks of the commissioning team. This list is not intended to be comprehensive and should be considered a general guideline for the Contractor without a defined commissioning process statement:
01 Program all power distribution panels
02 Setup and program all network control devices
03 Setup and initial programming of control console
04 Setup and initial programming for all architectural control devices
05 Program all emergency lighting control devices

3.5 FINAL OBSERVATION & TESTING

A. Upon completion of installation, initial adjustments, tests and measurements specified in Part 3, and submission and review of the results, a final inspection and test will be observed by the Consultant.

B. Testing will include operation of each major system and any other components deemed necessary. Contractor will assist in this testing and provide all test equipment noted below. Contractor shall provide at least two (2) technicians available for the entire testing period (day and night), to assist in tests, adjustments, and final modifications. Testing process is estimated to take a minimum of one (1) day.

C. Provide the following test gear:
01 Circuit Tester with adapters for all connectors present in the system.
02 Multimeter capable of measurements up to 600V AC/DC, 10A DC, and 2MOhms
03 DMX Tester
04 Industrial Ethernet Tool capable of testing signal continuity and distance from source

D. The following procedures will be performed on each System:
01 Observation of the physical installation including labeling, mounting, and finish of all equipment and components which are a part of the System.
02 Functional testing of all control devices and devices under control within the System.

03 Review of programming and standard settings for all control interface devices.
04 Load circuit verification.
05 Control circuit verification.
06 Other tests on equipment or systems deemed appropriate.

E. The Consultant will provide the Owner with a listing describing any incomplete or otherwise deficient items determined as part of the testing process. Where further adjustment or work becomes evident during testing, the Contractor is to continue work until the System is complete.

3.6 INSTRUCTION OF OWNER PERSONNEL

A. Provide operations and service training on all equipment incorporated in the System.

B. Training shall not be conducted until final observation and testing is completed by the Consultant, unless otherwise directed by the Owner.

C. Provide (6) hours of training. Training time shall be conducted in multiple sessions, with each session not to exceed four hours. Training shall be conducted in accordance with Owner's schedule.
01 Six months after completion of initial training, schedule an additional (4) hours with Owner for review of systems and equipment operation.

D. The major equipment components and subject matter are as follows (advisory percentage of overall time allocated):
01 Power Distribution System (20%)
a. Basic testing and control
b. Normal and emergency operations
c. Programming memory
d. Software configurations and upgrades
e. Troubleshooting.
02 Control Console (40%)
a. Operational training, including offline or remote-access software
b. Patching and programming
c. Fixture integration
d. Peripheral hardware
e. Applications interface for retrieving information from the control console
f. Troubleshooting
g. Upgrades
03 Architectural Controls (20%)
a. Part of training will be to establish programmed looks for the performance areas with the end-user. The Contractor shall provide all equipment to establish DMX values for preset looks.
b. Snapshotting preset onto DMX controller
c. Preset recall operation
d. Normal operations (e.g., console arbitration, time-clock controlled events, etc.)
e. Troubleshooting.
04 Theatrical Lighting Fixtures and Accessories (20%)
a. Hang and focus
b. Cabling and circuiting

c. Setup and DMX addressing
d. Troubleshooting

E. Training Schedules
01 Training should be assumed to take place on the project site.
02 Training should be scheduled to be non-overlapping.
03 Actual training schedule shall be by agreement with Owner.
04 In the event that a portion of the training time is occupied in troubleshooting the equipment installation, then the training time shall be extended an equal amount of time.

F. Submit an outline of the course with sample instructional aides for approval thirty (30) days prior to scheduled instruction sessions to architect and architect's consultant.

G. Following discussions with Owner, provide a Training submittal 2-4 weeks prior to first training. Submittal shall:
01 Include a separate page/entry for every training session.
02 Indicate date, time, and approximate length of training session.
03 Indicate person(s) conducting training.
04 Indicate whether training will be video recorded.
05 Intended curriculum and most appropriate attendees (e.g., technician, operations, IT, etc.)
06 Include signature and title lines for:

a. Owner acknowledging and accepting training schedule. Include both an Accepted and Rejected box. An alternate schedule time should be suggested by the Owner in the event the schedule is rejected.
b. Countersigning by trainer indicating that training actually occurred.
c. All persons attending training. Where attendees do not stay for the entire session, this should be noted on the form and initialed by Owner's representative attending training.
d. Owner's representative attending training at the end of the session shall initial that:
1. Training Occurred.
2. Training Materials were provided and left with Owner
3. Training was not interrupted or shortened by equipment or system troubleshooting. If it is, then there should be a line where Owner and Contractor can indicate when make-up training will be provided and how long it should be.
4. Training was generally sufficient for the proposed curriculum.

07 Include Notes section for Owner and Contractor to note any issues during training (areas requiring further development, etc.)

H. Following training occurrence, submit completed training records no later than 5 days following end of training. When training is conducted over a period of weeks, completed training submittals shall be consolidated into a single submittal and submitted every 2 weeks.

3.7 EVENT ATTENDANCE

A. Contractor shall attend the first facility use or event as directed by the Owner.
01 Event Attendance includes the following requirements:

a. Attendance shall begin at the first crew call and conclude when the crew is released. During these events perform such tasks (e.g., assistance with

patching, programming, troubleshooting cabling problems, etc.) as requested by User. Tasks shall be strictly assistance, not operation.

b. Event support personnel shall be a technician associated with the original installation and commissioning.

c. In the event that the system is used prior to final acceptance, attendance in support of system usage shall not be construed as acceptance or as event attendance.

02 Coordinate these schedules with the Owner.

END OF SECTION 11 61 62

SECTION 12 21 13

HORIZONTAL LOUVER BLINDS

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide horizontal blinds at all new exterior windows.
   02 Provide at new interior windows as indicated or scheduled on the Drawings.
   03 Provide horizontal blinds at all windows where glazing is being replaced.

C. Related Work:
   01 Section 08 11 13 – Hollow Metal Doors and Frames.
   02 Section 08 80 00 – Glazing.

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

E. Color / Finish Samples:
   01 Provide two (2) samples of each finish for selection by the Architect.
   02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.

1.3 REFERENCES

A. NFPA 701 – Standard Method of Fire Tests for Flame Propagation of Textiles and Films

1.4 QUALITY ASSURANCE

A. Installer Qualifications:
   01 Installer shall be qualified to install specified products by prior experience and approved by the manufacturer.
   02 Installer shall be responsible for acceptable installation in accordance with instructions published by manufacturer.
   03 Single Source Requirement: provide horizontal louver blinds from the same manufacturer for the entire project.

B. Mockup(s): Build mockups to verify selections made, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   01 Approval of mockup(s) does not constitute approval of deviations from the Contract Documents unless Architect specifically approves such deviations in writing.
   02 Subject to compliance with requirements, approved mockup(s) may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 WARRANTY

A. Warranty the work specified herein for lifetime, without charge to the original purchaser, any part found defective in workmanship or material as long as the blind remains in the same window for which it was purchased.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Design of horizontal louver blinds is based on products manufactured by SWFcontract by Spring Window Fashions, LLC.

B. Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this section, provided all proposed products meet or exceed the specified requirements.
   01 Bali Classics Custom Mini Blinds.
   02 Hunter Douglas, Inc.
   03 Levolor Blinds

2.2 MATERIALS

A. Design of horizontal louver blinds is based on SWF Classics 1” Cordless Aluminum Blinds

B. Horizontal blinds shall consist of the following:

   01 Headrail shall be 1” high x 1-1/2” wide x .025” thick U-shaped steel. The steel finishing process includes phosphate treatment for corrosion resistance, a chrome-free sealer, a low hazardous air pollutants (HAP) urethane primer, and a topcoat of low HAP polyester-baked enamel.
   02 Tilter shall be made of injection-molded thermoplastics for smooth low-friction operation and shall incorporate a clutch mechanism to prevent damage due to over tilting.
   03 Tilt Rod shall be electro-zinc coated solid steel measuring 1/4” square.
   04 Tilt Wand shall be clear polycarbonate with a hexagonal cross section measuring approximately 1/4" diameter and attached to the tilter shaft by means of a spring clip for easy removal.

05 Drum and Cradles shall be low-friction thermoplastic and provided for each ladder.

06 Installation Brackets shall be made of phosphate-treated steel with a urethane primer and polyester-baked enamel finish to match headrail. The design shall incorporate a hinged front cover.

07 Braided ladder shall be made of 100% polyester yarn, incorporating two extra-strength rungs per ladder for slat support. Standard ladder spacing shall be 21.5 mm.

08 Slats shall be 5000 series cold-rolled aluminum containing the maximum allowable recycled content to produce a high-strength and corrosion-resistant flexible product. Slats shall be nominally 1" wide x .006" thick and processed to provide a smooth, hard, less porous surface with antistatic performance to repel dust. Slats shall be treated with a topcoat of polyester-baked enamel. Slats to meet NFPA 701.

09 Bottomrail shall be completely enclosed tubular shape made of phosphate-treated steel for corrosion resistance and finished with a chrome-free sealer, low HAP urethane primer, and a topcoat of low HAP, polyester-baked enamel. Bottomrail shall measure .025" thick.

10 Operation: No Lift/ Wand tilt only (no exceptions). Cordless lift blinds with or without hold-down clips are not acceptable.

11 Finish: Color as selected by the Architect from manufacturer's full range of selections.

a. Blinds at Black Box K102 and Control Room K111 are to be black.

PART 3 - EXECUTION

3.1 FABRICATION

A. Fabricate blinds to fit outside to outside of window frame, with length to extend full height down to sill / floor as applicable, unless indicated otherwise on the Drawings.

B. For windows without a horizontal mullion, fabricate blinds to fit inside the head frame, unless indicated otherwise on the drawings.

C. For windows with full-depth intermediate horizontal mullions, fabricate blinds to fit inside the head frame to extend down to the intermediate mullion below, and similarly inside the frame at each intermediate mullion as required to cover the entire window, unless indicated otherwise on drawings. At windows with undersized intermediate mullions, fabricate blinds to fit inside the head frame to extend full height of window.

D. For window blinds mounted at 9'-0" or above, provide extensions to control mechanisms.

3.2 INSTALLATION

A. Install blinds at all new interior and exterior windows and at existing frames where glazing is being replaced under 10 feet (with the exception of doors), and other locations scheduled or noted on the drawings in accordance with manufacturer's installation procedures, except as otherwise specified herein.

B. Install intermediate support brackets and extension brackets as needed to prevent deflection in headrail.

C. Inside mount blinds with adequate clearance to permit smooth operation of blinds and any sash operators. Hold blinds 1/4 inch clear from each side of window opening unless other clearance is indicated.

D. Set tilt and locking controls. Demonstrate blinds to be in smooth uniform working order.

3.1 CLEANING AND DEMONSTRATION

A. Clean blinds in accordance with manufacturer's instructions.

B. Demonstrate blinds to be in smooth uniform working order.

END OF SECTION

SECTION 12 32 16

MANUFACTURED PLASTIC-LAMINATE-CLAD CASEWORK

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Plastic laminate clad casework.
   02 Plastic laminate clad countertops.
   03 Casework hardware and accessories.
   04 Other miscellaneous plastic laminate clad work as indicated on the Drawings.

C. Related Work:
   01 Section 04 20 00 – Unit Masonry
   02 Section 06 10 00 – Rough Carpentry
   03 Section 06 20 00 – Finish Carpentry
   04 Section 09 21 16 – Gypsum Board Assemblies
   05 Section 11 30 00 – Residential Appliances
   06 Division 22 – Plumbing
   07 Division 26 – Electrical

1.2 SUBMITTALS

A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.

B. Submit a copy of the Specification Section with any / all proposed deviations clearly marked and identified in red text / markings.
   01 For each item of non-compliance, indicate such and provide complete, detailed description of what is proposed in lieu of the specified item / requirement.
   02 Proposed alternatives for items of non-compliance may be accepted or rejected by the Architect; and in the case of rejection, the specified requirements shall be met.

C. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

D. Proof of AWI Quality Certification Program accreditation.

E. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.

02 Generic details that do not depict actual conditions shall not be acceptable.

F. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
01 Show profiles, sizes, spacing and locations of assembled components.
02 Show details of shop fabrications, connections and details, including details of all joinery and assemblies.
03 Show details of field fabrications, connections and details.
04 Provide full elevations of all proposed casework. Indicate dimensions, materials and finishes. Indicate all locations to receive filler panels.
05 Show locations of hardware, sinks, service fixtures, trim and other pertinent data for each unit.
06 Indicate proposed laminate materials (type and thickness) for every surface of the cabinet unit (exposed, semi-exposed, interior and concealed).

G. Sample Cabinet:
01 Submit typical sample base cabinet (with base) representative of all proposed methods of construction, assembly, joinery and finish.
02 Sample must include a minimum of one drawer, one door, one interior shelf, slides, key lock, thumb latch, shelf supports and removable countertop with attached backsplash.
03 Sample cabinet does not need to have specific, selected plastic laminate finishes for this project.
04 Once accepted, the sample cabinet shall be used as the basis to evaluate all casework provided for the project.
05 Sample cabinet shall not be used in final construction of project.

H. Samples:
01 Submit plastic laminate samples (exposed surfaces and liners) of the full range of colors, patterns, textures and finishes from the manufacturer's standard colors, for Architect's selections.
02 Submit full range of selections available for 3mm PVC edge banding and PVC flat edge banding.
03 Submit samples of all hardware components proposed to be used.

I. Maintenance Instructions: Provide preprinted maintenance instructions for the casework hardware.

J. Close-out Submittals:
01 Updated as-built drawings, specifications and shop drawings.
02 Manufacturer contact names and addresses.
03 Product laminate/stain color numbers, etc.
04 Provide three (3) master keys (E41A), three clinic keys (AUE39) and five (5) locks of each type used for owner stock. All casework keys shall be turned over to the CFISD Maintenance Department, not given to the school.

1.3 DEFINITIONS

A. Identification of casework components and related products by surface visibility.
01 Exposed Surfaces: Any unit exterior surface exposed after installation (door and drawer faces, face frames, exposed ends, unit tops below 72” AFF, and bottoms of upper cabinets above 60” AFF).

02 Semi-Exposed Surfaces: Tops of units above 72” AFF, bottoms of upper cabinets below 60” AFF, unit interiors which are visible).
03 Open Interior Surfaces: Any open unit without solid door or drawer front, units with full glass insert doors and/or acrylic doors, and units with sliding solid doors.
04 Closed Interior Surfaces: Any visible surface behind solid door or drawer fronts.
05 Concealed Surfaces: Any surface not visible after installation (unit backs and ends when adjacent to another unit.

1.4 QUALITY ASSURANCE

A. Manufacturer: Minimum of five (5) years of experience in providing manufactured casework systems for similar types of projects, and adequate facilities and personnel required to perform on this project in accordance with the specified requirements.

B. Manufacturer: Provide products certified as meeting or exceeding ANSI-A 161.1-2000 testing standards.

C. Single Source Manufacturer: Casework, countertops and other plastic laminate architectural products must all be engineered and built by a single source manufacturer in order to ensure consistency and quality for these related products.

D. Quality Standard: Unless otherwise indicated or specified, comply with AWI’s Architectural Woodwork Quality Standards for grades of interior architectural woodwork, construction, finishes and other requirements.

E. The manufacturer shall be a member of AWI and shall be Quality Certification Program accredited:
01 Provide AWI Quality Certification Program Certificate indicating that the woodwork complies with requirements of the grade specified.
02 This project has been registered as AWI/QCP Certification Program project number.
03 The contractor, upon award of work, shall register the work under this section with the AWI Quality Certification Program.

1.5 WARRANTY

A. Furnish a written warranty that Work performed under this Section shall remain free from defects as to materials and workmanship for a period of five (5) years from date of substantial completion. Defects in materials and workmanship that may develop within this time are to be replaced without cost or expense to the Owner.

B. Defects include, but are not limited to:
01 Ruptured, cracked, or stained coating.
02 Discoloration or lack of finish integrity.
03 Cracking or peeling of finish.
04 De-lamination of components or edge-banding.
05 Slippage, shift, or failure of attachment to wall, floor, or ceiling.
06 Weld or structural failure (visible weld marks).
07 Warping or unloaded deflection of components.
08 Failure of hardware.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this Section, provide all proposed products meet or exceed the specified requirements.
   01 Ameritek Design, Inc.
   02 Calmar Manufacturing Co., Inc. (Tru-Bilt System One)
   03 Global Casework Manufacturing, Inc.
   04 Jericho Woodworks
   05 Jim Reynolds & Associates
   06 K P Kabinets
   07 Labsource (Case Systems, Inc.)
   08 MGC, Inc.
   09 South Texas Woodmill, Inc.
   10 Steven's Industries

B. Plastic Laminate: The following manufacturers are acceptable to provide plastic laminate:
   01 Formica
   02 Wilson Art

C. Hardware: The following manufacturers are acceptable to provide casework hardware:
   01 Knape & Vogt
   02 National
   03 Stanley
   04 Ives

2.2 GENERAL

A. In addition to the above requirements, manufacturers requesting approval shall, at the same time, submit certified product test data in accordance with ANSI A161.1-1980, NEMA LD3-2000, and general static load testing performed and certified by an independent testing agency, covering the following areas of product performance, with these minimum results:
   01 Base cabinet construction/racking test: 800 lbs.
   02 Cabinet front joint loading test: 425 lbs.
   03 Wall cabinet static load test: 2,000 lbs.
   04 Drawer front joint loading test: 600 lbs.
   05 Drawer construction/static load test: 750 lbs.
   06 Cabinet adjustable shelf support device/static load test: 300 lbs.

B. The following performance details are project requirements and must be met by all bidders whether named herein, or approved by Addendum, regardless of that manufacturer's "Standards". Deviations will not be allowed.
   01 Minimum Quality Standard: comply with AWI's Architectural Woodwork Quality Standards section 400 - Custom Grade for grades of interior architectural casework, woodwork, construction, finishes and other requirements; except as modified by this specification.
   02 Cabinet Construction: All core materials shall be of an industrial grade, medium density particle board with non-formaldehyde binders. Board shall exceed performance requirements for ANSI A208.1-1999 M2 Standards.

03 Structural Cabinet Body: Cabinet backs shall be inset from rear of body, and fully bound (dadoed) four sides. Provide 3/4 inch (19.1 mm) thick stiffeners fastened to back/body as specified herein. Back perimeter shall be toe-nailed with mechanical fasteners for tight interior fit and direct connection of back panel to body and sealed with full-perimeter high-strength hot-melt adhesive.

04 Interior Structure: All cabinets over 36 inches (914 mm) wide shall be furnished with a mechanically fastened, yet removable, vertical divider to reduce horizontal member/shelf deflection. Wall cabinets shall have a clear inside nominal depth of 12 inches (305 mm) unless detailed otherwise.

05 Shelf Loading: Shelves shall meet the loading/deflection standards of the National Particleboard Association.

06 Structural Drawer Body: Drawer body shall be doweled with 1/2 inch typical bottom, recessed, fully bound (dadoed) and joint-glued all four sides. Provide under body stiffeners as specified herein.

07 Drawer Suspension: Drawer slides shall be self-closing design, with positive in-stop, out-stop, and out-keeper. Dynamic (operational) load rating shall be minimum 100 lbs. Minimum 150 lbs. static load rating.

08 Structural Cabinet Support: Cabinet sub-base shall be of a separate and continuous ladder-type platform design, leveled and floor mounted prior to cabinet body placement. No cabinet sides-to-floor will be allowed.

C. Architect / Owners opinion and decision shall be final in the evaluation of manufacturer's products for approval to bid or award of contract.

2.3 CORE MATERIALS

A. High Performance Core Material:

01 All core materials shall be an Industrial Grade particle board which shall meet or exceed performance requirements for ANSI A208.1-1999 M2 Standards.

02 All core materials shall be minimum 43 lb. density.

03 All core materials shall have a minimum 250 lb. screw holding capacity on the face plane and minimum 225 lb. screw holding capacity on the edge plane.

B. Cabinet components shall be of the following minimum core thicknesses:

01 Cabinet backs, drawer body, and drawer bottoms: 1/2" minimum.

02 Door and drawer face, base, tops (excluding countertops) and bottoms, cabinet sides, drawer spreaders, cabinet back rear hang-strips, structural dividers, exposed cabinet backs, up to 36” wide: 3/4 inch minimum.

03 All shelves: 3/4-inch thick plywood for 30 inches long or less; 1-inch thick plywood for more than 30 inches.

04 Product-specific work surfaces, countertops and library stack shelving unless stack fitted with vertical divider: 1” minimum.

05 Backsplashes and End Panels: 3/4 inch minimum. Backsplashes and End Panels to be 4 inches high unless otherwise shown.

C. Marine Grade Plywood:

01 APA Grade A-A, made entirely of Douglas-fir or Western Larch.

02 All inner plies Grade B or better.

03 All glues and adhesives shall be waterproof.

04 Material shall comply with Voluntary Product Standard PS1-95 – Construction and Industrial Plywood.

2.4 LAMINATE MATERIALS

A. All laminates shall meet or exceed NEMA LD3-2000 standards; including thicknesses for stated laminate types / grades.

B. All lamination shall be performed with hybrid P.V.A. Type III water resistant adhesive.

C. Lamination System – Exposed Vertical Applications: Doors, finished end panels, and other vertical, exposed laminate surfaces shall be laminated with:
   01 Minimum VGS – General Purpose grade laminate at .030" high-pressure plastic laminate. Color / pattern as selected by the Architect.
   02 Balancing sheet shall be same grade and thickness as finished face laminate. Color at concealed locations shall be Contractor's option.

D. Lamination System – Exposed Vertical Applications: Backsplash exposed laminate surfaces shall be laminated with:
   01 Minimum HGP – Postforming grade laminate at .035" high-pressure plastic laminate. Color / pattern as selected by the Architect.
   02 Balancing sheet shall be same grade and thickness as finished face laminate. Color at concealed locations shall be contractor's option.

E. Lamination System – Exposed Horizontal Applications: Countertops exposed laminate surfaces shall be laminated with:
   01 Minimum HGP – Postforming grade laminate at .042" high-pressure plastic laminate. Color / pattern as selected by the Architect.
   02 Balancing sheet shall be same grade and thickness as finished face laminate. Color at concealed locations shall be Contractor's option.

F. Lamination System – Exposed Horizontal Applications: Cabinet tops (other than countertops) and bottoms, drawer and shelf components exposed laminate surfaces shall be laminated with:
   01 Minimum VGS – General Purpose grade laminate at .030" high-pressure plastic laminate. Color / pattern as selected by the Architect.
   02 Balancing sheet shall be same grade and thickness as finished face laminate. Color at cabinet interiors shall match cabinet liner color as selected by the Architect.

G. Lamination System – Concealed Cabinet Backs and Ends: Concealed backs and ends of cabinet boxes that are finished with a 0.020" interior cabinet liner shall be minimum BKL – Unfinished Backing Sheet at 0.020".

H. Laminate color selections:
   01 Standard laminate finishes from casework manufacturer's standard stock colors consisting of wood grain patterns, patterned colors and solid colors. Minimum of 200 selections available.
   02 Allow a total of five (5) different colors / patterns to be selected per project.
   03 Direction of wood grain shall be vertical on door, end panels, fascia panels, and exposed backs and ends; horizontal on drawer faces, aprons, and top rails.
   04 Exposed cabinet interiors not concealed by doors shall be a laminate as selected by the Architect.
   05 Unless otherwise noted, cabinet interiors concealed by doors shall be white.

2.5 EDGING MATERIALS

A. Edging types. Provide one or more of the following in accordance with "Edging Locations":
   01 3 mm thick PVC: Solid, high-impact, purified, color-thru, acid resistant, pre-lamination primed edging, machine-applied with hot melt adhesives, automatically trimmed, inside/outside length-radiused for uniform appearance, buffed and corner-radiused for consistent design.
   02 Flat Edge PVC: one (1) mm. Solid, high-impact, purified, color-thru, acid resistant PVC edging, machine-applied with hot melt adhesives, automatically trimmed face, back and corners for uniform appearance.

B. Edging Locations. Provide the above specified edging types at the following locations, of the following colors:
   01 Door/Drawer-Front edging: 3mm PVC selected from a minimum of 30 standard colors, color matched to standard laminates.
   02 Cabinet body edge, including door/drawer front spacer rail: Flat Edge PVC, color matched to door / drawer face or as selected.
   03 Forward edge of interior body components, interior dividers, shelf, and top edges of drawer body: Flat Edge PVC to match cabinet interior surface color.

2.6 DETAILED REQUIREMENTS FOR CABINET CONSTRUCTION:

A. Base Cabinet Sub-Base:
   01 All base cabinets shall be mounted on sleeper sub-base assemblies completely separate from the cabinet body.
   02 Vertical cabinet body components extending to the floor shall not be accepted.
   03 Cabinet sub-base shall be continuous and separate from base cabinets. Individual sub-bases attached to each base cabinet box shall not be accepted.
   04 Sub-base assemblies shall be fabricated from minimum 1-1/2” thick components, using one or more of the following materials / assemblies:
      a. Komatex PVC Board; min. 19 mm thick. Provide multiple layers as required to reach desired overall thickness.
      b. Palram Palight PVC Board; min. 19 mm thick. Provide multiple layers as required to reach desired overall thickness.
      c. Pre-drill holes and countersink screws as required.
   05 Sub-base shall be ladder-type construction of individual front, back, ends and intermediates, to form a secure and level platform to which base cabinets attach.
      a. The front of sub-base shall be a single continuous member wherever possible; and where not possible due to the length of the base cabinet bank, shall have joints at not less than 96” apart.
   06 Provide plastic shims as required to level the sub-base along its entire length.
   07 Sub-bases at exposed cabinet end panels shall be recessed 1/4 inch from face of finished end, facilitating flush installation of finished base material by other trades.
   08 No particleboard material shall be installed within four (4) inches of the floor.
   09 Leave toe spaces unfinished for installation of resilient base or other scheduled base as indicated on drawings.

B. Cabinet Top and Bottom:
   01 Solid sub-top shall be furnished for all base and tall cabinets.
   02 At cabinets over 36 inches, bottoms and tops shall be mechanically joined by a fixed divider.
   03 Exposed wall cabinet bottoms shall be Pressure Fused white laminate. Assembly devices shall be concealed on bottom side of wall cabinets.

C. Cabinet Ends:
   01 Exposed exterior cabinet ends shall be laminated with high-pressure plastic laminate, balanced with high-pressure cabinet-liner interior surface.
   02 Holes drilled for adjustable shelves shall be 1-1/4” on center to within 6” of top and bottom of cabinet.

D. Cabinet Backs:
   01 Cabinet back shall be fully bound (dadoed) into sides, top frame, and bottom, recessed 7/8 inch from cabinet rear.
   02 Back shall be secured to cabinet body with mechanical fasteners and solidified with a continuous bead of industrial grade hot melt adhesive.
   03 Hang rails shall be located at rear of cabinet back and fastened to cabinet sides.
      a. Provide minimum of 2 at base cabinets, 2 at upper wall-hung cabinets, and 3 at tall cabinets.
   04 Stand-alone units shall have individual backing for moving purposes.
   05 Exposed exterior backs shall be high-pressure plastic laminate balanced with high-pressure cabinet-liner.
   06 Material shall be non-moisture wicking/absorbing material. No particleboard is allowed within four (4) inches of the floor.

E. Door and Drawer Fronts:
   01 Drawer fronts and hinged doors shall overlay the cabinet body.
      a. Maintain a maximum 1/8 inch reveal between pairs of doors, between door and drawer front, or between multiple drawer fronts within the cabinet.
   02 Laminated door and drawer fronts shall be 13/16 inch thick to provide a flush / on-plane appearance.
   03 Stile and rail doors shall be 13/16 inch thick with full 1/4 inch plate glass.
      a. To be hinged or sliding as indicated on the Drawings.
      b. All exposed lite-opening edges shall be trimmed and glazed with extruded glazing bead.
   04 Frameless sliding glass doors shall be 1/4 inch thick clear, laminated safety glass with ground and polished edges. See Paragraph 2.8 HARDWARE for frame and rollers.

F. Drawers:
   01 Drawer fronts shall be applied to separate drawer body component sub-front.
   02 Drawer sides shall be dadoed or lock and shoulder joints
   03 Drawer bottom shall be fully bound (dadoed) into front, sides, and back. Routing, in drawer body for bottom, shall receive continuous glue. Drawer bottom to be routed in and let in all four (4) sides of drawer box.
   04 Reinforce drawer bottoms with 1/2 inch x 4 inch intermediate underbody stiffeners, mechanically fastened, run front to back.
      a. Drawers less than 27” wide do not require stiffeners.

b. Provide one stiffener at drawers 27” to 35” wide.
c. Provide two stiffeners at drawers 36” to 48”.

05 Drawers to be used for flat paper storage shall be fitted with a 6” deep, full width hood at back of drawer.

06 Drawer body shall be constructed of laminated plywood. Particleboard drawer bodies are not acceptable.

07 Drawer fronts shall be constructed of laminated plywood.

G. Fixed and Adjustable Shelves:

01 Thickness shall be 3/4" plywood for units up to 30” wide.

02 Thickness shall be 1” plywood for units wider than 30”.

H. Vertical and Horizontal Dividers: One of the following as indicated on the Drawings or by cabinet number:

01 Natural hardboard 1/4" thick, smooth both faces. Secure in cabinet with molded plastic clips.

02 Plastic laminate clad, 1/2" or 3/4" thick core material. Sub-dividers shall be secured in cabinet with molded plastic clips or dowels.

03 Structural dividers in cabinets over 36” wide shall be secured in cabinet with mechanical euro fasteners.

I. Door / Drawer Front Rail: Provide minimum 3/4" x 6” x full width cabinet body rails immediately behind all door/drawer and multiple drawer horizontal joints to maintain exact body dimensions, close off reveal, and be locator for lock strikes.

J. Countertops:

01 High-pressure plastic laminate bonded to core. All countertops shall be medium density particle board or plywood, except countertops within 36” of a sink shall be marine grade veneer plywood.

02 Core thickness: 1-1/4”. Underside shall be fully balanced with equal thickness balancing / backing sheet.

03 Back-splashes and end-splashes shall be 3/4" x 4” unless shown otherwise on the Drawings. Face and top of splashes shall be plastic laminate clad to match countertops, balancing sheets on concealed sides.

04 Furnish countertops with edge treatment, backsplash and design profile as indicated on Drawings.

05 Provide tops in as long as practical continuous lengths. Provide field glued splines at joints.

06 No countertop or plastic laminate joints closer than 24” either side of sink cutout or at knee spaces.

07 Mobile cabinet tops shall be high-pressure plastic laminate on exterior and high-pressure cabinet-liner on underside. Edges shall be high-impact 3 mm PVC.

08 Exposed corner of countertop must have 1-1/2 inch radius.

09 All window sills to have radius corners of 1 inch or more.

2.7 WORKMANSHIP

A. All exposed exterior cabinet surfaces shall be thicknesses specified, high-pressure laminate, color as selected by the Architect.

01 Laminate surface / balancing liner to core under controlled conditions by approved and regulated laminating methods to assure a premium lamination.

02 Natural-setting hybrid P.V.A. Type III water resistant adhesives that cure through chemical reaction, containing no health or environmentally

hazardous ingredients, are required. Methods requiring heat are not allowed; "contact" methods of laminating are not allowed.

03 Laminate to match adjacent case-piece.

B. Cabinet parts shall be accurately machined and bored for premium grade quality joinery construction utilizing automatic machinery to insure consistent sizing of modular components. End panels shall be doweled to receive bottom and top.

C. Back panel shall be fully bound (dadoed) into, and recessed 7/8” from the back of cabinet sides, top, and bottom to insure rigidity and a fully closed cabinet. Cabinet back shall be mechanically fastened from rear of body for tight interior fit and sealed with full-perimeter high-strength hot-melt adhesive.

D. Drawer bottom shall be fully bound (dadoed) and glued into and recessed 1/2" up from the bottom of sides, back, and sub-front. Sides of drawer shall be doweled to receive drawer back and sub-front.

E. 3/4 inch thick hang rails shall be mechanically fastened to end panels of all wall, base, and tall cabinets for extra rigidity and to facilitate installation.

F. All cases shall be square, plumb, and true.

G. Case body and drawer workmanship and quality of construction shall be further evidenced by Independent Testing Laboratory results.

H. Provide removable back panels and closure panels for access plumbing behind cabinet at all sink base cabinets, and where shown on Drawings. Not applicable at base cabinets where water supply and sanitary is directly routed into a CMU back up wall.

I. ADA, Americans with Disabilities Act Requirements: The following special requirements shall be met, where specifically indicated on Architectural Plans as "ADA", or by General Note. Shall be in compliance with Federal Register Volume 56, No. 144, Rules and Regulations:

01 Countertop height: With or without cabinet below, not to exceed a height of 34” A.F.F. (Above Finished Floor) at a surface depth of 24 inches.

02 Knee Space Clearance: Provide a minimum of 29” A.F.F. at apron, and minimum 30” clear span width. Typical at sinks that are open below.

03 At sinks open below, provide a 3/4" x full width, plastic laminate clad, removable panel in front of sink and plumbing piping. Panel shall be attached to the adjacent base cabinet, both sides.

04 Sink cabinet clearances: In addition to above, upper knee space frontal depth shall be no less than 8”, and lower toe frontal depth shall be no less than 11” at a point 9” A.F.F., and as further described in Volume 56, Section 4.19.

05 12” deep shelving, adjustable or fixed: Not to exceed a range from 9” A.F.F. to 54” A.F.F.

06 Wardrobe cabinets: Shall be furnished with rod &shelf adjustable to 48” A.F.F. at a maximum 21” shelf depth.

J. Provide backsplashes and end splashes wherever a back or end is next to a wall, whether shown on drawings or not. Caulk at all walls.

K. All units with exposed backs, interiors, ends and/or bases shall be plastic laminate clad with colors as selected by Architect.

L. Provide matching fillers and scribes to fit cabinets to partitions and columns.

M. Provide closure panels at top and bottom of wall-hung cabinets at corner intersections.

2.8 HARDWARE

A. Hinges: Heavy duty, five-knuckle, 2-3/4" institutional type hinge shall meet ANSI/BHMA A156.9 Grade 1 requirements. Design is based on Stanley Hardware No. HT1591 Casework Hinge, or approved equal.
   01 Mill ground, hospital tip.
   02 Hinge shall be full wrap around type of .088" thick tempered steel.
   03 Each hinge shall adjustable in both vertical and lateral directions to assure positive door attachment and alignment.
   04 Provide one pair per doors up to 48-inch height; and one and one-half pair on doors over 48" in height.
   05 Hinge shall accommodate 13/16" thick laminated door and allow 270 degree swing.
   06 Finish shall be 26D satin chromium plated finish.

B. Pulls: Wire design, solid brass, 4" x 1-5/16" projection. Design is based on Stanley #348315-4; or approved equal.
   01 Finish shall be 26D satin chromium plated finish.

C. Locks: Provide the following, no substitutions.
   01 Cabinet locks, except at clinic, shall be National model C8053 five-pin disc tumbler locks with non-removable core. Keyed, removable cores will not be allowed. Provide grooved key type, nickel-plated cylinder and cam. Locks are to be master keyed to E41A
   02 Clinic locks: CCL cam lock Model No. B15760-US26D keyed to AUE39. Stamp AUE39 on cam lock face. All clinic cabinet locksets shall function so that the key to the lock can only be removed when the lock is in the LOCKED position, except at one (1) cabinet designated by the District to hold emergency supplies. The key to the emergency cabinet shall be able to be removed in the unlocked position.
   03 Cabinet locks in each room shall be keyed alike. All casework in school shall be on one Owner's master key, approved by Owner.
   04 Dull chrome finish.
   05 Provide Stanley No. 36 catches on non-active leafs on door pairs.
   06 Provide cabinet locks on all units with the exception of casework doors that access plumbing behind the cabinet doors. Stamp all locks with key number on face of cam lock.
   07 Provide two (2) keys per lock, maximum 10 keys per room.
   08 Provide sample of cabinet lock for approval by CFISD locksmith and obtain approval before ordering locks.
   09 Contractor to provide all casework keys in individually labeled envelopes per classroom. A transmittal showing room number, key number, and quantity of keys shall be included. All casework keys shall be turned over to the CFISD Maintenance Department, not given to the school.
   10 Provide cabinet locks on all units, unless specifically stated otherwise on drawings.
   11 All hardware shall be subject to approval by the Owner/Architect. At existing campuses, all keying shall match existing master key system.

D. Standard Drawer Slides:

01 Standard Drawers: Full extension, telescopic, heavy-duty, self-closing design, steel ball bearing operation with positive in-stop, out-stop. Design is based on Knape & Vogt # 8417; or approved equal.

02 Full extension, Minimum 100 lb. dynamic load rating life cycle test and 150 lb. static load rating. Electro-zinc plated with lacquer top coat.

E. File Drawer Slides:

01 File Drawers: Full extension, 3-part progressive opening slide on precision steel ball bearings; minimum 100 lb. dynamic load rating; hold-in feature to prevent bounce-back; positive in / out stops. Design is based on Knape & Vogt # 8500; or approved equal.

02 Provide integral, body mounted molded steel rails for hanging file system for legal and letter file drawers. Cutting or machining of drawer body / face is not allowed.

03 Provide electro-zinc plated with lacquer top coat.

04 Hanging file drawer shall accept letter-size hanging files.

F. Catches: Catch shall provide opening resistance in compliance with the Americans with Disabilities Act.

01 Non-Locking Doors: Provide top-mounted magnetic catch for base and wall cabinet doors. Provide two at each tall cabinet door. Design is based on EPCO no. 592; or approved equal.

02 Locking Pair of Doors: Furnish an elbow catch on the door leaf not receiving a lock. One required on doors up to 48 inches tall and two required (top and bottom) on doors over 48 inches tall. Design is based on EPCO no. 1018; or approved equal.

G. Adjustable Shelf Supports: Twin pin design with anti-tip-up shelf restraints for both 3/4" and 1” shelves.

01 Design shall include keel to retard shelf slide-off, and slot for ability to mechanically attach shelf to clip.

02 Load rating shall be minimum 300 lbs. each support without failure.

03 Cabinet interior sides shall be flush, without shelf system permanent projection.

H. Sliding Glass Door Hardware:

01 Framed Assembly Sliding Doors: Design based on EPCO Assembly 16 (modified to #730 head / jamb track), complete for the intended installation; or approved equal.

02 Provide continuous top and jamb tracks, continuous glazing shoes, track base with double track, and rollers.

03 Provide sliding Glass Door Lock: Ratchet type lock. Design is based on EPCO G05 series locks; or approved equal. Key to building master.

I. Wardrobe Rod: Shall be 1-1/16” rod, supported by flanges both sides, chrome finish; or equal. Hanging rod in teacher wardrobe to be mechanically fastened and non-removeable.

J. Coat Hooks:

01 Single prong coat hooks, ceiling mount. Satin finish.

02 Double prong coat hooks, ceiling mount. Satin finish.

K. Grommet:

01 Design is based Doug Mockett & Co. Model “EDP”, 2-1/2” minimum diameter, round grommet with flip top series; or approved equal.

02 Provide one (1) grommet at each non-plumbing knee space with power and data below countertop.
03 Provide 2-1/2” chrome grommets at cosmetology stations.
04 Color: Black

L. Fasteners:
01 All fasteners shall be of such type and length to withstand a minimum pull-out force of 200 LBS.
02 All screw fasteners shall extend a minimum of 67% into the substrate it is being used on.
03 Screw fasteners shall be countersunk type at all hardware fabricated to accept countersunk screws.
04 All screw fasteners shall be cadmium plated or stainless steel.
05 All screws seated directly against a cabinet panel shall be provided with appropriately sized washers.

M. Label Holder:
01 Size: 1/2” high x 2-3/16” wide
02 Finish: Brass
03 Side Insert
04 Provide one per opening, and on both sides of mailbox if open on both sides, whether shown on drawings or not.

2.9 SPECIAL MATERIALS

A. Glass:
01 Glass for framed and unframed doors shall be 1/4" thick clear laminated safety glass, complying with ASTM C1172, Kind LT, Condition A, Type 1, Class 1.

PART 3 - EXECUTION

3.1 INSPECTION

A. Carefully inspect all casework upon delivery. All units damaged upon arrival shall be returned to the manufacturer for repair and / or replacement.

B. Any / all units which do not have required balance sheets on concealed surfaces shall be returned to the manufacturer for repair and / or replacement. Field application of balance sheets shall not be allowed.

C. Leave protective shipping materials in place until casework is delivered to its final room destination. Use all means necessary to protect adjacent work during transit and installation in the building.

3.2 PREPARATION

A. Coordinate with other trades as required for proper installation of blocking in walls, etc. for secure attachment of casework. Verify exact field installed locations.

B. Inspect the installed work of other trades and verify that such work is complete to the point where this installation may properly commence. Closely inspect the squareness and flatness of walls behind cabinets to facilitate a tight, even fit of

casework to wall. Coordinate with other trades as required for corrective prep work.

C. Inspect conditions at floor slabs for proper installation of cabinet sub-bases. Coordinate with other trades as required for corrective prep work.

D. Verify rough plumbing and electrical work is properly located to permit casework, fixtures and equipment to be installed in strict accordance with the original design, pertinent codes, and regulations, and reviewed Shop Drawings.

E. In the event of discrepancy, immediately notify the Architect. Do not proceed with installation in areas of discrepancy until such discrepancies have been resolved.

3.3 INSTALLATION

A. Casework base cabinet components / boxes shall be assembled in the configurations and locations as indicated on the Drawings.
   01 Securely anchor base cabinets to sub-base and through back to wall blocking at top of casework.
   02 Securely fasten casework base cabinets through sides to adjacent base cabinet(s).
   03 In as much as practical, standardize fastener locations at each cabinet to maintain a uniform appearance.

B. Casework upper wall cabinet components / boxes shall be assembled in the configurations and locations as indicated on the Drawings.
   01 Wall cabinets shall align with base cabinets unless specifically shown otherwise on the Drawings.
   02 Securely anchor upper wall cabinets through back to wall blocking at top and bottom of each cabinet.
   03 Securely fasten casework upper wall cabinets through sides to adjacent upper wall cabinet(s).
   04 In as much as practical, standardize fastener locations at each cabinet to maintain a uniform appearance.

C. Provide matching fillers and scribes to fit cabinets to partitions, columns and other adjacent interfacing work. At wall-to-wall conditions, center cabinets for equal fillers / scribes each end.

D. Provide closure panels at top and bottom of upper wall cabinets at blind corner and similar locations.

E. Verify lengths of countertops, splashes, and sub-bases. Provide in longest practical lengths to minimize splices in plastic laminate. Securely fasten countertop to each base cabinet from the underside through the top of the base cabinet.

F. Provide back-splashes and end-splashes wherever a back or end is adjacent to a wall, whether shown or not.

G. Plumbing and electrical items shall be furnished under the Plumbing and Electrical Section.
   01 Installation of work furnished by the various trades shall be coordinated to assure properly functioning equipment at the completion of the job.

02 The casework supplier shall be responsible for all cutouts necessary to receive plumbing items. Provide 'J' clamps to secure sinks to countertops.

H. Seal all joints in countertops, splashes and walls continuous with clear acrylic sealant.

I. Provide a bed of sealant under all backsplashes and all end panels.

J. Environmental requirements:
01 Do not install casework until HVAC systems are operating and temperature and humidity have been stabilized for at least one (1) week.
02 Manufacturer/Supplier shall advise Contractor of temperature and humidity requirements for architectural casework installation areas.
03 After installation, control temperatures and humidity to maintain relative humidity between 25 and 55 percent.

3.4 ADJUSTMENT

A. Doors:
01 Upon completion, adjust all doors / hinges to be hung plumb and square, resulting in a consistent gap between pairs of doors at +/- 1/8".
02 Verify that magnetic catches and latches are positioned correctly to hold door in tight, fixed position. Adjust as required.

B. Drawers:
01 Upon completion, adjust all drawers to function easily and smoothly, without binding or shimmying.
02 Verify that drawers with automatic closing hardware function properly.

C. Locks:
01 Verify all proposed locations with Architect prior to commencement.
02 Verify locks in each room / area are keyed in accordance with the Owner's standards and direction.
03 Install locks in cabinets as indicated on the Drawings or directed by the Architect.
04 Provide stops, catches and similar hardware, properly placed to provide positive locking.
05 Using cabinet body and similar components as stops / catches is prohibited.

D. Final Cleaning: Upon completion of all final adjustments, thoroughly clean all debris from cabinets; including, but not limited to: glue, sealant, pencil marks, saw-dust, wood shavings, loose hardware, smudges, dirt and other similar items.

END OF SECTION

SECTION 13 12 30

PRE-ENGINEERED GREENHOUSE STRUCTURE

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01. Provide a pre-engineered greenhouse, including the substructure, aluminum framing, vents, doors, polycarbonate panels, trim, base plates, and accessories at the location shown on the drawings.
   02. All masonry, flashing, foundation work, plumbing, mechanical, electrical (including control wiring), and utility connections shall be provided and installed by other trades. Coordinate with other trades as required.

C. Related Work:
   01. Section 01 11 23 – Code Summary
   02. Section 03 30 00 – Cast-In-Place Concrete
   03. Section 04 20 00 – Unit Masonry
   04. Section 08 71 00 – Door Hardware
   05. Section 08 80 00 - Glazing
   06. Division 22 - Plumbing
   07. Division 26 – Electrical
   08. Division 27 – Communications
   09. Division 28 – Electronic Safety and Security
   10. Section 32 13 13 – Concrete Paving and Flatwork

1.2 QUALITY ASSURANCE

A. Installation of the pre-engineered greenhouse shall be performed by one of the following:
   01. Authorized builder or contractor of the manufacturer having a minimum of five years experience in installations of this type.
   02. Contractor authorized by the manufacturer as trained and qualified to erect the manufacturer's product and have a minimum of five years experience in installations of this type.

B. Manufacturer's Qualifications: provide pre-engineered greenhouse as produced by a manufacturer with not less than five years successful experience in the fabrication of pre-engineered greenhouse of the type and quality required.

1.3 SUBMITTALS

A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01. Show profiles, sizes, spacing and locations of assembled components.
   02. Show details of shop fabrications, connections and details.
   03. Show details of field fabrications, connections and details.
   04. Provide calculations demonstrating compliance with wind load and other requirements.
   05. Shop Drawings shall be sealed and signed by a Texas Registered Engineer.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01. Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02. Generic details that do not depict actual conditions shall not be acceptable.

E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01. Include recommended cleaning products and instructions for use.
   02. Where applicable, provide recommended maintenance schedules and procedures.

F. Color / Finish Samples:
   01. Provide two (2) samples of each finish for selection by the Architect.
   02. Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
   03. Minimum size shall be 3" x 3" but must be large enough to convey attributes of the proposed product.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver framing members, panels and trim items to the project site with no dents, scratches, or abraded areas. Deliver in manufacturer's standard bundles, securely bound and store at the project site raised above slab or ground level on pallets.

1.5 DESIGN REQUIREMENTS

A. Design Code: Structural design for the building structural system shall be provided by the metal building system manufacturer by a structural engineer licensed to practice in the State of Texas for the following design criteria:
   01. International Building Code (IBC) 2018.
   02. Storage Building Occupancy Category: Utility and Miscellaneous, Group U.

B. Wind Load Requirements:

01. Exposure: B.
02. Risk Category: III
03. Wind Speed: 140 MPH, 3 second gusts.

C. Design Loads:
01. Dead Load: Weight of the structure as determined by the manufacturer.
02. Roof live load: Per the building code referenced in paragraph 1.5A
03. Collateral load: Per the building code referenced in paragraph 1.5A
04. Wind load: Reference paragraph 1.5B
05. Seismic load: N/A
06. Auxiliary loads: Auxiliary loads shall include dynamic loads, such as cranes and material handling systems.

1.6 WARRANTY

A. Greenhouse shall be warranted free from defects under normal use and conditions for five years from substantial completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE PRODUCTS/MANUFACTURERS

A. Basis of Design: A Gable Select, pre-engineered truss design, free standing, full span greenhouse (no center post) as manufactured by Next G3N Greenhouse, LLC, Chino, CA (909) 315-6400. www.nextg3ngreenhouse.com.
01. Roll-formed galvanized steel, Gable Select series, galvanized, extra-strength steel substructure, designed to be installed on a 32-inch high knee wall, covered in 8mm solar soft (muted) twin wall polycarbonate. **Note: Round, square or rectangle tubing is not allowed for structural trusses or purlins. Roll-formed galvanized steel is the only acceptable material for superior strength.**
a. One, full-length, 54” x 72’, automated ridge vent, complete with 100NM DC motor and motor control.
b. Front door, 48 x 80” heavy-duty steel, ADA compliant, with frame, jambs, and hardware. Top half is tempered glass.
c. Back side door to be 36” x 80” heavy-duty steel, ADA complaint, with frame, jambs, and hardware. Top half is tempered glass.
d. All doors to be lockable using district BEST cores.
02. Approximate dimensions: 30’ wide x 72’ long x 17’ high (peak) from finished floor grade.
03. Provide climate control package, which includes the following. The design of the flowing equipment is based upon a 45° temperature differential between inside and outside temperatures, 5,000 ft. candles of light and a 7° pad to fan rise in temperature (include thermostat).
a. One Modine PTP 300 gas heater with vent kit (or equivalent).
b. One, 5’ x 20’ x 6” evaporative cooling system with mounting brackets and stainless steel, self-contained reservoir. Include thermostat.
c. Four Quietaire or eqivalent 18” Horizontal Air Flow fans.
d. One, 5’ x 20’ endwall rack and pinion lifting vent with 100NM DC motor with motor control.
04. Shading Device:

a. One set Shade Fabric Panels (63%) with taped and grommeted edges for easy attachment (EXTERIOR SHADE).

05. Stationary Benches:
    a. Provide stationary galvanized steel benches with poly bench tops as indicated on the drawings.
06. Irrigation and mister package:
    a. Provide four (4) runs of overhead misting and two (2) runs of hanging basket irrigation.
    b. Include fertilizer injector.

B. Alternate Manufacturers:
01. (Peak) House Greenhouse System as designed by Greenhouse Megastore (217) 709-1832.
02. Prospiant, Classroom Cultivator, 5513 Vine St., Cincinnati, OH.
03. Other manufacturers must have a minimum of five (5) years of experience manufacturing greenhouses, meeting or exceeding the requirements in this section, and comply with Division 1 requirements regarding substitutions in order to be considered.
    a. Greenhouse shall be a steel framed, single glazed, straight sidewall structure with gutters. Provide all structural members, bracing, clips, lugs, fasteners, and accessories required to complete the greenhouse system described (and meet the structural design criteria) whether itemized in these specification and drawings or not.

2.2 STRUCTURE AND DESIGN

A. Steel Substructure: consists of columns, roof chords and trussing, purlins and girts as described in 2.3 Materials below. Column spacing to be 12'.

B. One (1), 5' x 20' endwall rack and pinion lifting vent with 100NM DC motor with motor control.

C. One (1), full-length, 54" x 72", automated ridge vent, complete with 100NM DC motor and motor control.

D. Front door, 48" x 80" heavy-duty steel, ADA complaint, with frame, jambs and hardware. Top half is tempered glass. Back side door to be 36" x 48" heavy-duty steel, ADA compliant, with frame, jambs, and hardware. Top half is tempered glass.

E. Panels:
01. 8mm twin-wall rigid polycarbonate panels, secured with aluminum H channels for horizontal securing and terminating into J channel and top and bottom with perforated tape at the bottom.
02. Provide Tek screws with rubber washers in accordance with manufacturer's required spacing.
03. Polycarbonate shall be diffused, such as Solar Soft, Solar Lite, etc. **Do not provide clear twin-wall polycarbonate panels.**

2.3 MATERIALS

A. Framing: All galvanized steel, pre-punched and bolted together design including:

01. Heavy-duty 4.0” O.D. round (or square) columns, 8 gauge on 12’ centers.
02. Two (2) 4.0” round up-right columns at each exposed end wall.
03. 3’ tall x 1-7/8” wide 18 gauge roll-formed horizontal framing girts and both exposed end walls and side walls complete with mounting tabs.
04. SUPERIOR STRENGTH 4” tall x 2-1/4” wide 16-gauge roll-formed upper chords assemblies on 12’ centers.
05. 3” tall x 1-7/8” wide 16-gauge roll-formed flush mounted purlins complete with condensate control channels.
06. 1-5/8” bottom chord 16-gauge plus 1-5/8” 16-gauge webbed supports supplied on 12’ centers.
07. Cable wind bracing.
08. Galvanized steel roll-formed gutters 16 gauge with 210 galvanizing finish complete with one (1) gutter outlet each (drainpipe and down spout to be provided by contractor).
09. Provide aluminum corner trim, aluminum ridge bar and aluminum gutter trim.
10. Provide aluminum gable end bar flashing at end walls.
11. Provide brackets and fasteners as required to assemble frame.
12. Base plates are required. Base plates shall be welded, not less than 3/8” thick.
13. Foundation bolts shall be determined by local authorities; expansion bolts are permissible rather than anchor bolts poured in place.
14. Glazing:
    a. 8mm twin-wall rigid polycarbonate panels, secured with aluminum H channels for horizontal securing and terminating into J channel and top and bottom with perforated tape at the bottom.
    b. Provide Tek screws with rubber washers in accordance with manufacturer’s required spacing.
    c. Polycarbonate shall be diffused, such as Solar Soft, Solar Lite, etc. **Do not provide clear twin-wall polycarbonate panels.**
15. Galvanized steel benches: eight (8) 6’ wide x 10’ long. Bench tops to be Dura Bench or equivalent molded polyethylene structural plastic tops.

2.4 CONSTRUCTION

A. Provide complete construction of greenhouse including mounting greenhouse frame, covering and mounting the greenhouse equipment. Concrete foundations, concrete sidewalks, installation of all electrical wiring, conduits, gas piping, vent piping, water lines, and internet connection to be furnished by other trades. Coordinate with other trades as required.

B. Site preparation to include grading, cutting, or filling as required to provide level greenhouse pad ready for erection of greenhouse.

C. Utilities shall be brought to the site by the General Contractor.

2.5 ELECTRICAL

A. Design, provide, and mount a complete electrical system in accordance with local codes and NEC (National Electric Code), including the main panel of rain

tight design, circuit breakers, emt conduit, conductors, and disconnects required by code.

B. Provide receptacles with weatherproof covers.

C. All equipment to be rated for damp location.

2.6 GAS PIPING

A. Design, provide, and install complete gas piping and venting system for gas unit heaters.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General: install polycarbonate panels and related items in accordance with greenhouse manufacturer's instructions.

B. Framing: erect structural framing true to line, level and plumb, rigid and secure. Level base plates to a true even plane with full bearing to supporting structures.

C. Equipment: Install all equipment to manufacturer's set standards. This includes, heater, evaporative cooling system, endwall lifting vent, roof vent, exhaust fans, horizontal air flow fans, doors and exterior shadecloth.

D. Install and secure stainless steel benches, trim and related items.

E. Upon completion of installation, test for leaks. Inspect for leaks, repair leaks and re-test sections until all sections are leak-proof.

3.2 CONTROL SYSTEM

A. Provide one (1) Wadsworth Step Up or Wadsworth Juniper Controller with necessary relays and contactor panel.
   01. Include Owner training.

3.3 INSTALLATION

A. Install greenhouse in accordance with manufacturer's instructions in location shown on drawings.

B. Coordinate dimensional requirements prior to fabrication.

3.4 ERECTION

A. Erection shall be in accordance with manufacturer's recommendations using erectors approved by manufacturer.

B. Erect greenhouse after all concrete and masonry in vicinity are complete and washed down.

C. Column sleeves and base plate anchor bolts, if shown or required, shall be furnished by the manufacturer and installed by the General Contractor to elevations and dimensions on approved shop drawings.

D. Install all columns and beams straight and true.

E. Install all flashing and closures required.

3.5 CLEANING AND PROTECTION

A. Care shall be taken to prevent damage or scratching of components. Damaged or scratched components will not be accepted.

END OF SECTION

SECTION 13 34 16.16

ALUMINUM BLEACHERS AND TEAM BENCHES

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB - Instructions to Proposers and Section AF – Subcontractor and Manufacturer Prequalification for substitutions.

B. Scope of Work:
   01 Steel framework.
   02 Aluminum seats, footplanks and riserplanks.
   03 Aluminum railings, steps and accessory items.

C. Related Work:
   01 Section 32 13 13 – Concrete Paving and Flatwork
   02 Section 32 31 31 – Chain Link Fences & Gates

1.2 SUBMITTALS

A. Provide all submittals in accordance with Section 01 33 00 – Submittal Procedure.

B. Submit manufacturer's printed specifications and shop drawings to Architect for approval within four weeks of award of contract.

C. Product Data: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

D. Cleaning and Maintenance Instructions: Provide preprinted cleaning and maintenance instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Southern Bleacher Co. of Graham, Texas.

B. Sturdisteel Co. of Waco, Texas, Type TE.

C. Alenco, Bryan, Texas.

D. Safeway Steel Products.

E. Miracle Recreation Equipment Co.

F. Sportsfield Specialties (team benches)

2.2 MATERIALS

A. Galvanized Steel: Structural fabrication with ASTM A529 steel. Shop connections are seal welded. After fabrication, all steel to be hot-dipped galvanized to ASTM A123 specification.

B. Extruded Aluminum:
   01 Seat Planks, Riser Planks, Step Risers: Extruded aluminum alloy 6063-T6, clear anodized 204R1, AA-M10C22A31, Class II, with a wall thickness of 0.094".
   02 Tread Planks: Extruded aluminum 6063-T6 alloy, mill finish with a wall thickness 0.094 inch.

C. Accessories:
   01 Channel End Caps: Aluminum alloy 6063-T6,clear anodized 204R1, AA-M10C22A31, Class II.
   02 Hardware:
      a. Bolts, Nuts: Galvanized or plated.
      b. Hold down Clip Assembly: Aluminum alloy 6061-T6.
   03 Guardrailing: Anodized aluminum rail 1-5/8" O.D. with galvanized chain link.
   04 Crossbraces: Extruded aluminum angle alloy 6061-T6, mill finish.
   05 Aisle Nose: Aluminum alloy, 6063-T6, black powder-coat finish.

D. Mudsills: All stands shall have 2" x 6" treated mudsills at every point where steel would otherwise be in contact with concrete, drilled for field bolting. Cut mudsill as required for drainage. Drainage cuts to be located 4 feet from front of bleachers and 4 feet from back of bleachers. Cuts to be approximately 12 inches wide. Where mudsills intersect inlet location(s), provide drainage cut, sized so that inlet cover can be removed for maintenance.

2.3 DESIGN CRITERIA

A. Design Loads:
   01 Live Load: 100 psf gross horizontal projection.
   02 Lateral Say Load: 24 plf seat plank.
   03 Perpendicular Sway Load: 10 plf seat plank.
   04 Wind Load: 30 psf vertical projection.
   05 Live load of Seat and Tread Plank: 120 plf
   06 Guardrailings shall be capable of resisting 50 plf horizontal load and 100 plf vertical load applied to top rail without causing permanent deformation.

NOTE: Support frame work shall not exceed 6'-0" on centers and be connected by crossbracing.

2.4 DESCRIPTION

A. Tennis Court Bleachers
   01 Southern Bleacher Co., Model 521 NE angle-frame, non-elevated bleacher.
   02 Five (5) rows, 21 feet long each
   03 Seats: 2" x 10" anodized aluminum planks with end caps.
   04 Treads: Two 2" x 11" mill aluminum planks with end caps. Tread depth is 24".
   05 Riser: 1" x 6.5" anodized aluminum plank beginning at row two, plus two 1" x 6.5" anodized aluminum planks at top row.

06 Aisles: Aisle to be provided with 34” high handrail and intermediate rail at approximately 22” above tread. Aluminum tread nosing shall be of contrasting color on aisle steps.
07 Guard Railing: Two lines of aluminum rail with chain link 42 inches above seat on both sides of bleacher and across back of bleacher.
08 Accessible seating: provide to meet ADA and local codes.
09 All connections made in shop to be shop welded.
10 Quantity: One unit per tennis court.

B. Team Benches
01 ATBBRPT – Portable Aluminum Team Bench with Back Rest as manufactured by Sportsfield Specialties or approved equal.
02 Provide one (1) per each tennis court.
03 Length of unit: 12’-0”.
04 Full welded frame fabricated with 2” x 2” x 1/8” square aluminum tubing
a. Durable powder coated finish. Color to be selected by architect from full range of standard colors.
b. Weather resistant and unsusceptible to rust.
05 100% preassembled.
06 5-year manufacturer’s limited product warranty.
07 Install at tennis courts at locations indicated on drawings or as directed by Architect in field.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install bleacher units on concrete slab.

B. Anchor framing to slab on 2x6 treated wood mudsills and shim as required for proper rigid support.

C. Perform work of this Section with competent mechanics skilled in bleacher work and under the direct control and supervision of bleacher manufacturer's representative.

D. Install bleachers in strict accordance with approved shop drawings and details.

E. Where erection is complete, the portion of site shall be cleared and bleachers and cleaned of all scrap and trash.

END OF SECTION

SECTION 13 34 19

METAL BUILDING SYSTEMS

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work: Work under this Section of the specifications shall include all labor, materials, equipment and appurtenances for the installation of complete pre-engineered building(s) as indicated on the Drawings and herein specified.
   01 To include all structural components and parts of the building, including, but not limited to, primary structural steel framing, purlins, girts, necessary bracing, struts, wall and roof openings, and connecting members.
   02 To include all roof and wall panels, flashing curbs, gutters and downspouts, integrated insulation, all with necessary closures and fasteners.
   03 Coordination of this Section of the Specifications with all other trades is mandatory, so that all phases of work will be properly coordinated and interfaced with the metal building systems.
   04 Interfacing work that may be provided by others includes, but is not limited to doors and frames, overhead doors, louvers, roof-top equipment, fireproofing, masonry, roof and wall insulation, and mechanical, electrical and plumbing work. Coordinate as required.

C. Related Work:
   01 Section 01 11 23 – Code Summary
   02 Section 05 12 00 – Structural Steel Framing
   03 Section 07 21 00 – Thermal Insulation
   04 Section 07 25 00 – Weather Barrier
   05 Section 07 41 13 – Metal Roof Panels
   06 Section 07 42 13 – Metal Wall Panels
   07 Section 07 62 00 – Sheet Metal Flashing
   08 Section 08 11 13 – Hollow Metal Doors and Frames
   09 Section 08 33 23.13 – Overhead Insulated Coiling Doors
   10 Section 08 71 00 – Door Hardware
   11 Section 08 90 00 – Louvers and Vents
   12 Section 10 73 26 – Aluminum Walkway Coverings

1.2 SUBMITTALS

A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer’s literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.
   04 Provide calculations demonstrating compliance with wind load and other requirements.
   05 Shop Drawings shall be sealed and signed by a Texas Registered Engineer.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01 Include recommended cleaning products and instructions for use.
   02 Where applicable, provide recommended maintenance schedules and procedures.

F. Color / Finish Samples:
   01 Provide two (2) samples of each finish for selection by the Architect.
   02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
   03 Minimum size shall be 3" x 3" but must be large enough to convey attributes of the proposed product.

1.3 REFERENCES

A. ASTM International:
   01 ASTM A36 – Standard Specification for Carbon Structural Steel.
   02 ASTM A48 – Specification for Gray Iron Castings.
   03 ASTM A123 – Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   04 ASTM A307 – Specification for Carbon Steel Bolts and Studs, 60 000 psi Tensile Strength.
   05 ASTM A325 – Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 KSI Minimum Tensile Strength.
   06 ASTM A354 – Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners.
   07 ASTM A475 – Specification for Zinc-Coated Steel Wire Strand.
   08 ASTM A490 – Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 KSI Minimum Tensile Strength.
   09 ASTM A500 – Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
   10 ASTM A529 – Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality.
   11 ASTM A563 – Specification for Carbon and Alloy Steel Nuts.
   12 ASTM A572 – Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.

13 ASTM A653 / A653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
14 ASTM A792 / A792M – Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
15 ASTM A992 – Standard Specification for Structural Steel Shapes.
16 ASTM A1011 – 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.
17 ASTM A1039 – Specification for Steel, Sheet, Hot Rolled, Carbon, Commercial, Structural, and High-Strength Low-Alloy, Produced by Twin-Roll Casting Process.
18 ASTM E96 / E96M – Standard Test Methods for Water Vapor Transmission of Materials.
19 ASTM E108—Spread-of Flame Testing: Class 1A Rating.
20 ASTM E283 – Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
21 ASTM E331 – Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
22 ASTM E1592 – Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
23 ASTM E1646 – Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.
24 ASTM E1680 – Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems.
25 ASTM E2140 – Test Method for Water Penetration of Metal Roof Panel Systems by Static Water Pressure Head.
26 ASTM F436 – Specification for Hardened Steel Washers.
27 ASTM F1145 – Specification for Turnbuckles, Swaged, Welded, Forged.
28 ASTM F1554 – Specification for Anchor Bolts, Steel, 36, 55, and 105-KSI Yield Strength.

B. American Institute of Steel Construction (AISC):
01 AISC Specification for Structural Steel Buildings.
02 AISC Serviceability Design Considerations for Low-Rise Buildings.

C. American Iron and Steel Institute (AISI):
01 AISI North American Specification for the Design of Cold-Formed Steel Structural Members.

D. American Welding Society (AWS):
01 AWS D1.1 / D1.1M – Structural Welding Code – Steel.
02 AWS D1.3 / D1.3M – Structural Welding Code – Sheet Steel.

E. Association for Iron & Steel Technology (AISE):
01 AISE 13 – Specifications for Design and Construction of Mill Buildings.

F. Metal Building Manufacturers Association (MBMA):
01 MBMA Metal Building Systems Manual.

1.4 DESIGN - GENERAL

A. Framing, glazing, doors and hardware, including installation requirements shall

be provided in strict accordance with code requirements.

B. Wind Load Requirements:
   01 Exposure: B.
   02 Risk Category: III
   03 Wind Speed: 140 MPH, 3 second gusts.

C. The building design incorporates the general design parameters of the metal building as it relates to the building architecture. These parameters include:
   01 Centerline of rigid frames.
   02 Locations of endwall columns.
   03 Eave height(s).
   04 Cantilever and supported overhangs.
   05 Wind bracing.
   06 Opening types, sizes and locations.

D. Reasonable considerations have been incorporated in the building design to allow for the design of the metal building by the manufacturer to conform to, adapt to and fit within the building architecture as indicated on the Drawings.

E. Special areas of consideration include wind frames / bents, bridging, angle bracing and rod bracing.

F. Deviations in the architecture of the building, as shown, in order to accommodate the metal building system design shall not be considered.
   01 The manufacturer shall design the building as required to conform to, adapt to and fit within the building architecture as indicated on the Drawings.

G. The general building design as indicated on the Drawings is based on use of an 8-inch roof purlins, eave struts and wall girts.
   01 The metal building design shall incorporate 8-inch members, increasing the gauge of the member(s) where required to meet design loads.

H. The metal building design shall accommodate collateral loads that are suspended from the roof structure. The minimum collateral loads shall be based on 3 PSF; however, review the Drawings as required to account for actual collateral loads imposed by other trades.

1.5 BUILDING NOMENCLATURE

A. Metal Building System: A building system that will employ the following as indicated on the Drawings:
   01 Either continuous or simple-span ‘Z’ or ‘C’-shaped cold-formed purlins or open-web steel joists for support of the roof cladding.
   02 Simple-span ‘Z’ or ‘C’-shaped cold-formed purlins or open-web steel joists for support of the steel wall cladding.
   03 Three-plate, built-up rigid space frames and/or cold-formed ‘C’ or hot-rolled I-shaped post-and-beam framing to support the roof and wall secondary members.
   04 All systems (cladding, roof and wall secondary, lateral primary framing, and longitudinal bracing) work together to provide resistance to vertical and lateral loading demands.

B. Gable Symmetrical: A continuous frame building with the ridge in the center of the building, consisting of tapered or straight columns and tapered or straight

rafters.

01 The sidewall girts may be continuous (by-passing the columns) or simple span (inset in the column line).

02 The rafters may or may not have interior columns.

C. Gable Asymmetrical: A continuous frame building with an off-center ridge, consisting of tapered or straight columns and tapered or straight rafters.

01 The eave height and roof slope may differ on each side of the ridge.

02 The sidewall girts may be continuous (by-passing the columns) or simple span (flush in the column line). The rafters may or may not have interior columns.

D. Single-Slope: A continuous frame building which does not contain a ridge but consists of one continuous slope from side to side.

01 The building consists of straight or tapered columns and tapered or straight rafters.

02 The sidewall girts may be continuous (by-passing the columns) or simple span (flush in the column line).

03 The rafters may or may not have interior columns.

E. Lean-To (LTO): A building extension, which does not contain a ridge, but consists of one continuous slope from side to side. These units usually have the same roof slope and girt design as the building to which they are attached and supported by.

F. Roof Slope: Pitch expressed as inches of rise for each 12" of horizontal run.

G. Building Width: Measured from outside to outside of sidewall secondary structural member (girt).

H. Building Eave Height: A nominal dimension measured from the finished floor to top flange of eave strut.

I. Building Length: Measured from outside to outside of endwall secondary structural member.

J. Auxiliary Loads: Dynamic loads induced by cranes, conveyors, or other material handling systems.

K. Collateral Loads: The weight of any non-moving equipment or material, such as ceilings, electrical or mechanical equipment, sprinkler systems, plumbing, or ceilings.

L. Dead Load: The actual weight of the building system (as provided by the metal building supplier) supported by a given member.

M. Floor Live Loads: Loads induced on a floor system by occupants of a building and their furniture, equipment, etc.

N. Roof Live Loads: Loads produced by maintenance activities, rain, erection activities, and other movable or moving loads but not including wind, snow, seismic, crane, or dead loads.

O. Roof Snow Loads: Gravity load induced by the weight of snow or ice on the roof, assumed to act on the horizontal projection of the roof.

P. Seismic Loads: Loads acting in any direction on a structural system due to the action of an earthquake.

Q. Wind Loads: The loads on a structure induced by the forces of wind blowing from any horizontal direction acting on all vertical, horizontal and sloped surfaces of the building.

1.6 DESIGN REQUIREMENTS

A. General:
   01 The building manufacturer will use standards, specifications, recommendations, findings and/or interpretations of professionally-recognized groups such as AISC, AISI, AWS, ASTM, CSA, CWB, MBMA, Federal Specifications, and unpublished research by MBMA as the basis for establishing design, drafting, fabrication, and quality criteria, practices, and tolerances.
   02 The Manufacturer's design, drafting, fabrication and quality criteria, practices, and tolerances shall govern, unless specifically countermanded by the Contract Documents.
   03 Design structural mill sections and built-up plate sections in accordance with code-appropriate edition of AISC's "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings", ANSI/AISC 360 ASD method.
   04 Cold-Formed steel structural members and panels will generally be designed in accordance with "Specifications for the Design of Cold-Formed Steel Structural Members", 2007 Edition, ANSI/AISI S-100-07.
   05 Design weldments per the following:
      a. Structural Welding: Design per AWS D1.1, “Structural Welding Code – Steel”, Latest Edition.
      b. Cold-Formed Welding: Design per AWS D1.3, “Structural Welding Code – Sheet Steel”, Latest Edition.

B. Design Code: Structural design for the building structural system shall be provided by the metal building system manufacturer for the following design criteria:
   01 International Building Code (IBC) 2018.
   02 Storage Building Occupancy Category: Utility, Group U.

C. Design Loads:
   01 Dead Load – Weight of the building system as determined by manufacturer.
   02 Roof Live Load: Per the building code referenced in paragraph 1.6B
   03 Collateral Load: Per the building code referenced in paragraph 1.6B
   Wind Load: Refer to paragraph 1.4.B.
   04 Seismic Load: NA
   05 Auxiliary Loads: Auxiliary loads shall include dynamic loads, such as cranes and material handling systems, and will be defined in the Contract Documents.

D. Roof canopies and roof extensions shall be designed for an uplift wind load of twice the basic wind pressure required for the building.

E. In the design of the wall components, including girts and wall panels, the design wind pressure acting inward shall be per the building code referenced in paragraph 1.6B

PART 2 - PRODUCTS

2.1 PRE-ENGINEERED BUILDING MANUFACTURERS

A. Design of metal building systems is based on Schulte Building Systems (SBS).

B. Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this Section, provide all proposed products meet or exceed the specified requirements.
   01 Alliance Steel Buildings
   02 American Steel Building
   03 Athens Steel Buildings
   04 Butler Manufacturing Company
   05 Kirby Building Systems
   06 Metallic Building Company
   07 Mid-West Building Company
   08 Nucor Building Systems
   09 Red Dot Building Systems
   10 USA Steel
   11 Varco Pruden
   12 Whirlwind Steel Building Company

2.2 MATERIALS – GENERAL

A. General:
   01 All framing members shall be shop-fabricated for bolted field assembly.
   02 Primary structural framing shall include the sloping rafters and columns (rigid frames), endwall columns, and wind bracing.
   03 Secondary structural framing shall include the purlins, girts, eave struts, flange bracing, sill support, slips, and other miscellaneous structural parts.
   04 Unless otherwise specified, the minimum thickness of framing members shall be as follows:
      a. Cold-formed secondary framing members 16 gauge
      b. Webs of welded built-up members 1/4"
      c. Flanges of welded built-up members 1/4"
      d. Bracing rods 1/2" diameter
   05 Cold-formed sections shall be manufactured by precision roll or brake forming. All dimensions shall be true, and the formed member shall be free of fluting, buckling or waviness.
   06 All shop connections shall be by welding in accordance with the AWS Structural Welding Code D1.1-72. Welders and welding operators shall have been previously qualified as provided in the code. All flange to web welds shall be continuous submerged or the shielded arc process. Butt welds in flange and web plates shall be full penetration.
   07 All field connections shall be field bolted with ASTM A325 (.0003 Bronze Zinc Plated) as shown on the Drawings. A325 bolts shall be tightened / torque as stipulated by the Registered Engineer responsible for the design.
   08 Where required, connections in secondary members shall be made with special 1/2" oval head, with hex nuts. The faying surfaces of all bolted connections shall be smooth and free from burrs or distortions.
   09 All framing members shall carry an easily visible identifying mark, either stamped, stenciled or painted.

B. Primary Framing Steel:
   01 Steel for hot rolled shapes must conform to the requirements of ASTM Specifications A-36, A-572 or A-992, with minimum yield of 36 or 50 KSI, respectively.
   02 Steel for built-up sections must conform to the requirements of ASTM A-1011, A-1018, A-529, A-572 or A-36 as applicable, with minimum yield of 42, 46, 50, or 55 KSI as indicated by the design requirements.
   03 Round Tube must conform to the requirements of ASTM A-500 Grade B with minimum yield strength of 42 KSI.
   04 Square and Rectangular Tube must conform to the requirements of ASTM A-500 Grade B with a minimum yield strength of 46 KSI.
   05 Steel for Cold-Formed Endwall "C" sections must conform to the requirements of ASTM A-1011 or A-1039 Grade 55, or ASTM A-653 Grade 55 with minimum yield strength of 55 KSI.
   06 X-bracing will conform to ASTM A-36 or ASTM A-529 for rod and angle bracing or ASTM A-475 for cable bracing.

C. Secondary Framing Steel:
   01 Steel used to form purlins, girts and eave struts must meet the requirements of ASTM A-1011 or ASTM A-1039 Grade 55 for primed material or ASTM A-653 Grade 55 for galvanized material with a minimum yield of 55 KSI.
   02 Design Thicknesses – Gauge to be determined by design to meet specified loading conditions.

D. All primary and secondary steel framing that is exposed to the exterior shall be hot-dipped galvanized after fabrication.

E. Exterior Panels:
   01 Roll-formed Galvalume®, pre-painted Galvalume® or Galvanized G90 Exterior-Side and G60 Interior-Side.
   02 Standing Seam Panels must have 50 percent minimum aluminum-zinc alloy- coating and conform to ASTM A792 or ASTM A653 with a minimum yield of 50 KSI.
   03 Through-fastened panels must have 50 percent minimum aluminum-zinc alloy coating and conform to ASTM A792 or ASTM A653 with a minimum yield of 50 KSI.
   04 Panel Finish:
      a. PVDF Finish: 70% PVDF paint system with a 30-year finish warranty.

F. Interior Panels:
   01 Roll-formed Galvalume®, pre-painted Galvalume® or Galvanized G90 Exterior-Side and G60 Interior-Side.
   02 Standing Seam Panels must have 50 percent minimum aluminum-zinc alloy- coating and conform to ASTM A792 or ASTM A653 with a minimum yield of 50 KSI.
   03 Through-fastened panels must have 50 percent minimum aluminum-zinc alloy coating and conform to ASTM A792 or ASTM A653 with a minimum yield of 50 KSI.
   04 Panel Finish:
      a. PVDF Finish: 70% PVDF paint system with a 30-year finish warranty.

G. Panel Fasteners:
   01 For Galvalume® and Painted finished roof panels: Long Life Cast Zinc

head.
02 For wall panels: Coated carbon steel.
03 Color of exposed fastener heads to match the wall and roof panel finish.
04 Concealed Fasteners: Self-drilling type, of size required.

H. Flashing and Trim: Match material, finish, and color of adjacent components.
01 Provide trim at rakes, including peak and corner assemblies, high and low eaves, corners, bases, framed openings and as required or specified to provide weathertightness and a finished appearance.

I. Roof Clips:
01 All clips must have factory-applied mastic and designed so that movement between the panel and the clip does not occur.
02 Short or Tall Fixed clips; shall be either 3-1/2 or 4-1/2” in height. Used for applications where only a moderate amount of thermal expansion and contraction in the roof panel is expected.
03 Short or Tall Sliding clips: shall be either 3-1/2 or 4-1/2” in height and provide either 1-7/8” or 3 7/8” of travel for panel thermal expansion and contraction, depending on clip choice.

J. Sealant and Closures:
01 Sidelaps: Factory applied non-skinning Butyl mastic.
02 Endlaps, Eave, Ridge Assembly, and Gable Flashings: Field applied 100% solids butyl-based elastomeric tape sealant, furnished in pre-cut lengths.
03 Outside Closures: Closed-cell, plastic or metal.
04 Inside Closures: Closed-cell, plastic or metal.

2.3 PRIMARY FRAMING

A. Rigid Frames: Fabricated as welded built-up "I" sections or hot-rolled sections.
01 Frame Design: Single Slope.
02 Frame Design: Lean-To.
03 Frame Type: Clear-Span.

B. Rigid Frame Columns:
01 Tapered.

C. Rigid Frame Rafters:
01 Tapered.

D. Endwall Frames / Roof Beams:
01 Fabricate endwall columns of cold-formed "C" sections, mill-rolled sections, or built-up "I" sections depending on design requirements.
02 Depth or endwall columns shall be 8”.
03 Wall girt framing at endwalls shall be flush framed at endwall columns.

E. Interior Columns: Columns supporting rafters of mainframes shall be of the following cross-section type(s):
01 Pipe (Round HSS).
02 Tube (Square HSS).
03 "I"-Shaped (Built-Up or Mill-Rolled depending on design requirements).

F. Finish:
01 Interior: Red-Oxide or Gray Primer.

02 Exterior: Hot-dipped galvanized after fabrication.

G. Field Bolted Connections: All field bolted connections shall be designed and detailed utilizing ASTM A-325 or A-490 depending on design requirement.

2.4 SECONDARY FRAMING

A. Purlins and Girts: Purlins and girts shall be cold-formed "Z" sections with stiffened flanges.
   01 Flange stiffeners shall be sized to comply with the requirements of the latest edition of AISI and LGSI.
   02 They shall be pre-punched at the factory to provide for field bolting to the rigid frames.
   03 They shall be simple or continuous span as required by design. Connection bolts will install through the purlin/girt webs, not purlin/girt flanges.

B. Purlins (Excluding Open Web Joists): Horizontal structural members which support roof coverings.
   01 Depth: To be determined by design: 8”, 10” or 12”.
   02 Maximum Length: To be determined by design.
   03 Finish at Interior Members: Red oxide or gray Primer.
   04 Finish at Exterior Members: Pre-Coated Galvanized.

C. Girts: Horizontal structural members that support vertical panels.
   01 Depth: To be determined by design: 8”, 10” or 12”.
   02 Maximum Length: To be determined by design.
   03 Finish at Interior Members: Red oxide or gray Primer.
   04 Finish at Exterior Members: Pre-Coated Galvanized.

D. Eave Struts: Unequal flange, cold-formed "C" sections or “Z” purlins.
   01 Depth: To be determined by design: 8”, 10” or 12”.
   02 Maximum Length: To be determined by design.
   03 Finish at Interior Members: Red oxide or gray Primer.
   04 Finish at Exterior Members: Pre-Coated Galvanized.

E. Base Framing: Base members to which the base of the wall covering may be attached to the perimeter of the slab; secured to the concrete slab with mechanical anchors.
   01 Base angle with flashing.
   02 Finish at Interior Members: Red oxide or gray Primer.
   03 Finish at Exterior Members: Pre-Coated Galvanized.

F. Building Systems Roof Joist System.
   01 Open web, parallel chord, simple span load carrying members suitable for the direct support of roof systems utilizing material sizes and yield strengths as required.
   02 Open web members shall be fabricated of material that conforms to the material specifications designated by the Steel Joist Institute as acceptable for this product.
   03 Bridging with welded connections.
   04 Joist attachment: Welded.

G. Wind Bracing:
   01 When the wind load is applied in a direction such that it is not resisted by the transverse rigid frames, provision shall be made to adequately transmit all wind forces on the building to the foundation.
   02 Provide diagonal roof rods, struts, wind columns, wind beams, etc., such that the forces are carried by truss action.
   03 It will be noted that diagonal rod bracing in the walls is not acceptable.
   04 Design of the building shall coordinate wind bracing to avoid conflict with doors and other openings through the exterior wall.

H. Flange Bracing: The inside flange of all rigid frames shall be braced laterally by angles connected to the flange and web of the frame and to the web of the purlin or girt so that the allowable compressive stress is adequate for any combination of loading.

2.5 ROOF AND WALLS PANELS

A. Roof Panels: **Refer to Section 07 41 13 – Metal Roof Panels**.

B. Wall, Liner and Soffit Panels: **Refer to Section 07 42 13 – Metal Wall Panels.**

C. Flashing and Trim: **Refer to Section 07 41 13 – Metal Roof Panels and Section 07 42 13 – Metal Wall Panels**.

D. The metal building system shall be designed and fabricated to accommodate the proper interface and installation of specified roof and wall panels.

2.6 ACCESSORIES

A. Canopies: Overhanging or projecting roof structures off the sidewall or endwall with the extreme end usually unsupported. For aesthetic application or to cover entrance or walkway.

B. Purlin Extensions: Overhanging or projecting roof structure at the end of a building.

C. Framed Openings:
   01 Used to frame out doors, windows, louvers, and any other openings.
   02 Framing shall be “C” section type framing as required to provide the rough opening required for installation of hollow metal frames, window frames, louvers and vents, and other similar through-wall and / or work to be provided by others.
   03 Coordinate as required to provide proper opening sizes.

D. Liner Panels: Refer to Section 07 42 13 – Metal Wall Panels.

E. Soffit Panels: Refer to Section 07 42 13 – Metal Wall Panels.

F. Roof Curbs:
   01 Refer to Section 07 41 13 – Metal Roof Panels.
   02 Welded units fabricated to integrate with metal roof panel profile application.
   03 Minimum 18-gauge Galvalume™ coated steel, with welds cleaned and treated with protective coating compatible with the Galvalume™ substrate.
   04 Top of curb to be level with ground, with 1 ½” top flange.

05 Curb walls insulated with 1 ½"-3lb.density fiberglass insulation.
06 Welded cricket on upslope side of curb to divert water.
07 Metal or plastic rib covers supplied loose for flexibility when installing curb.
08 Standard sub-frame shall be minimum 16-gauge steel and shall support all 4 sides of the curb.
09 All fasteners and sealants required for installation shall be furnished by Roof Curb manufacturer.

G. Pipe Flashings: Aluminum base with EPDM boot. The base flange must bend to form a seal with surface irregularities or roof pitch.
01 Size: ¼" to 4" (6 to 102mm) Pipe.
02 Size: 4" to 7" (102 to 178mm) Pipe.
03 Size: 7" to 13" (178 to 330mm) Pipe.

2.7 OTHER COMPONENTS

A. Roof Curbs:
01 Roof-top equipment curbs shall be specifically designed to interface with the roof panel profile.
02 Curbs shall be fabricated from minimum 16-gauge galvanized sheet metal; and heavier where required to meet loads.
03 Curbs shall be located to span the minimum number of panel seams. Coordinate with other trades as required to position interfacing work below the roof accordingly.
04 Curbs shall be fabricated with integral crickets to divert water around the curb.
05 Curbs shall be fabricated to account for roof slope so that all roof-top equipment is mounted level and plumb.
06 Provide continuous secondary sub-framing at all sides of roof curbs.
07 Finish at roof curbs shall match color of roofing panels.

B. Penetration Flashing:
01 At pipe penetrations, provide a flexible, one-piece, flashing boot specifically made to be installed on metal roofing.
02 Material shall be EPDM with a corrosion resistant aluminum collar for attachment to the roof panel.
03 Design is based on "Dektite" Pipe Flashing; or an equal approved by the Architect.
04 Flashing to be set on a full bed of sealant.
05 All pipe flashing shall be installed on the 'flat' of the roof panel. Prior to making roof penetration, coordinate with other trades as required to ensure pipe flashing will not be installed on or over a panel ridge.

C. Ridge Vents: Provide two (2) full-length, manually-operated ridge vents on each side of ridge that cannot be unseated in high winds.
01 Vents to open/close via chain. Length of chain shall be sufficient to operate when standing on the floor without a ladder or step stool assist.

2.8 RELATED ACCESSORIES

A. **Refer to Section 08 11 13 – Hollow Metal Doors and Frames.**

B. **Refer to Section 07 21 00 – Thermal Insulation.**

C. **Refer to Section 08 90 00 – Louvers and Vents.**

D. **Section 08 33 23 – Overhead Coiling Doors.**

E. Fans: Refer to Mechanical Drawings and Division 23 for locations, conditions and additional information.

2.9 BUILDING ANCHORAGE & FOUNDATION

A. The building anchor bolts and related anchorage shall be designed to resist the column reactions resulting from the specified loads as applied in the specified loading combinations.
   01 The sizes and design shall be specified by the building manufacturer.
   02 Coordinate with the Contractor regarding supplying and installing anchor bolts.

2.10 FABRICATION

A. General:
   01 Shop-fabricate all framing members for field bolted assembly. The surfaces of the bolted connections must be smooth and free from burrs or distortions.
   02 Shop connections must conform to the manufacturer's standard design practices as defined in this section. Certification of welder qualifications will be furnished when required and specified in advance.
   03 All framing members must carry an identifying mark.

B. Primary Framing:
   01 Plates, Stiffeners and Related Members.: Factory weld base plates splice plates, cap plates, and stiffeners into place on the structural members.
   02 Bolt Holes and Related Machining: Shop fabricate base plates, splices and flanges to include bolt connection holes. Shop fabricated webs to include bracing holes.
   03 Secondary structural connections (purlins and girts) to be ordinary bolted connections, which may include welded clips.
   04 Manufacturer is responsible for all welding inspection in accordance with the manufacturer's IAS Accreditation or CAN/CSA A660 Certification.
   05 Non-Destructive Testing (NDT) - NDT shall be performed and documented as required by the governing building code for this project.

C. Zee Purlins:
   01 Fabricate purlins from cold-formed "Z" sections with stiffened flanges.
   02 Size flange stiffeners to comply with the requirements of the latest edition of AISI. Connection bolts will install through the webs, not the flanges.

D. Girts:
   01 Girts must be simple or continuous span as required by design.
   02 Connection bolts will install through the webs, not the flanges.

E. Column Base Plates:
   01 Heights of columns shall be designed to allow for a nominal 1/2" shim space below all primary framing base plates.

F. Diagonal Bracing:
   01 Wind bracing in the roof and/or walls need not be furnished where it can be shown that the diaphragm strength of the roof and/or wall covering is adequate to resist the applied wind or seismic forces.
   02 Diagonal bracing in the roof and sidewalls may be used to resist longitudinal loads (wind, crane, etc.) in the structure if diaphragm action cannot be used.
   03 Do not locate diagonal bracing at locations that interfere with openings in exterior walls.
   04 Diagonal bracing will be furnished to length and equipped with hillside washers and nuts at each end. It may consist of rods threaded each end or galvanized cable with suitable threaded end anchors. If load requirements so dictate, bracing may be of structural angle and/or pipe, bolted in place.

G. Special Bracing:
   01 When diagonal bracing is not permitted in the sidewall, a rigid frame type portal or fixed base column will be used.
   02 Shear walls can also be used where adequate to resist the applied wind or seismic forces.

H. Flange Braces:
   01 The compression flange of all primary framing must be braced laterally with angles connecting to the bottom chords of purlins or to the webs of girts so that the flange compressive stress is within allowable limits for any combination of loading.

PART 3 - EXECUTION

3.1 EXAMINATION

A. The erector shall examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of Work.

B. Before erection proceeds, the erector survey elevations and locations of concrete and masonry bearing surfaces and locations of anchor rods, bearing plates and other embedment's to receive structural framing for compliance with requirements and metal building system manufacturer's tolerances.

C. Proceed with erection only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads equal in intensity to design loads. Remove temporary supports when permanent structural framing connections and bracing are in place, unless otherwise indicated.

3.3 ERECTION - FRAMING

A. Erect framing in accordance with MBMA Low Rise Building Systems Manual,

Common Industry Practices.

B. The erector shall furnish temporary guys and bracing where needed for squaring, plumbing, and securing the structural framing against loads, such as wind loads acting on the exposed framing and seismic forces, as well as loads due to erection equipment and erection operation.
   01 Temporary guys, braces, etc. shall not be anchored directly to the building slab.
   02 All temporary guys, braces, false-works and cribbing shall be removed immediately upon completion of erection.

C. Do not field cut or alter structural members without approval of the metal building manufacturer's registered Structural Engineer.

D. After erection of all shop primed members, prime welds, abrasions, and marred surfaces resulting from erection / installation.

E. After erection of galvanized members, touch up all welds and abrasions with a zinc-rich / cold galvanizing paint

3.4 ERECTION - WALL AND ROOFING SYSTEMS

A. Install in accordance with reviewed Shop Drawings and manufacturer's standards and instructions.

B. Exercise care when cutting prefinished material to ensure cuttings do not remain on finish surface.

C. Provide continuous sealant / sealant tape at all panel joints.

D. Fasten cladding system to structural supports, aligned level and plumb.

3.5 ERECTION - GUTTER AND DOWNSPOUT

A. Install in accordance with reviewed Shop Drawings and manufacturer's standards and instructions.

B. Connect downspouts to storm sewer system or provide precast concrete splash-blocks as indicated on the Drawings.

C. Provide strap anchors at 10'-0" maximum at all downspouts; minimum three (3) per downspout.

3.6 INSTALLATION - ACCESSORIES

A. Refer to other Sections and coordinate with other trades as required for the proper installation and interface of Work not included in this Section. Work includes, but is not limited to:
   01 Hollow metal doors and frames
   02 Overhead doors
   03 Aluminum windows
   04 Louvers

B. Seal all accessories weather-tight.

3.7 TOLERANCES

A. All work shall be performed in a workmanlike manner.

B. Install Framing in accordance with MBMA Low Rise Building Systems Manual, Common Industry Practices.

3.8 PROTECTION AND CLEAN-UP

A. Upon completion of the Work, remove all debris related to the Work of this Section.

B. Particular attention shall be made in removing metal shavings, screws, and other debris from roof panels.

C. Use all means necessary to protect installed work and finishes prior to Substantial Completion and acceptance by the Owner.

D. Contractor shall not place company name or logo on any part of the building.

END OF SECTION

SECTION 21 01 00

FIRE PROTECTION OPERATING AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Compilation product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare operating and maintenance data as specified.

B. Instruct Owner's personnel in operation and maintenance of equipment and systems.

C. Submit three copies of complete manual in final form.

1.2 SUBMITTALS

A. Thirty (30) days after the Contractor has received the final scheduled identified submittals bearing the Architect / Engineer's stamp of acceptance (including resubmittals), submit for review one copy of the first draft of the Operating and Maintenance Manual. This copy shall contain as a minimum:
   1. Table of Contents for each element.
   2. Contractor information.
   3. All submittals, coordination drawings and product data, reviewed by the Architect / Engineer; bearing the Architect / Engineer's stamp of acceptance. (When submittals are returned from Engineer "Correct as Noted", corrected inserts shall be included.)
   4. All parts and maintenance manuals for items of equipment.
   5. Warranties (without starting dates)
   6. Certifications that have been completed. Submit forms and outlines of certifications that have not been completed.
   7. Operating and maintenance procedures.
   8. Form of Owner's Training Program Syllabus (including times and dates).
   9. Control operations/equipment wiring diagrams.
   10. Other required operating and maintenance information that are complete.

B. Copy will be returned to the Contractor within 15 days with comments for corrections.

C. Submit completed manuals in final electronic form to the Architect / Engineer one day after substantial completion, and prior to Owner's instructions. Include all specified data, test and balance reports, drawings, dated warranties, certificates, reports, along with other materials and information.

D. The Architect / Engineer will review the manuals for completeness within fifteen (15) days.

E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Architect / Engineer. The manuals will not be retransmitted.

F. Completed electronic manuals will be delivered to the Owner.

PART 2 - PRODUCTS

2.1 BINDERS

A. Commercial quality black three-ring binders with clear overlay plastic covers.

B. Minimum ring size: 1".
Maximum ring size: 3".

C. When multiple binders are used, correlate the data into related groupings.

D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

3.1 OPERATION AND MAINTENANCE MANUAL

A. Form for Manuals:
   1. Prepare data in form of an instructional manual for use by Owner's personnel.
   2. Format:
      a. Size: 8-1/2" x 11".
      b. Text: Manufacturer's printed data or neatly typewritten.
   3. Drawings:
      a. Provide reinforced punched binder tab and bind in text.
      b. Fold larger drawings to size of text pages.
   4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
   5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
      a. Title of Project
      b. Identity of separate structures as applicable.
      c. Identity of general subject matter covered in the manual.
   6. Binder as specified.

B. Content of Manual:
   1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
      a. Contractor, name of responsible principal, address and telephone number.
      b. A list of each product required to be included, indexed to content of the volume.
      c. List with each product, name, address and telephone number of:
         1) Subcontractor or installer
         2) Maintenance contractor as appropriate
         3) Identify area of responsibility of each
         4) Local source of supply for parts and replacement
      d. Identify each product by product name and other identifying symbols as set forth in Contract Documents.
   2. Product Data:
      a. Include those sheets pertinent to the specific product
      b. Annotate each sheet to:
         1) Identify specific product or part installed
         2) Identify data applicable to installation
         3) Delete references to inapplicable information. (All options not supplied with equipment shall be marked out indicated in some manner.

3. Drawings:
    a. Supplement product data with drawings as necessary to illustrate:
        1) Relations of component parts of equipment and systems
        2) Control and flow diagrams
    b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
    c. Do not use Project Record Documents as maintenance drawings.
4. Written text, as required to supplement product data for the particular installation:
    a. Organize in consistent format under separate headings for different procedures.
    b. Provide logical sequence of instructions for each procedure.
5. Copy of each warranty, bond and service contract issued.
    a. Provide information sheet for Owner's personnel, giving:
        1) Proper procedures in event of failure
        2) Instances that might affect validity of warranties or bonds
6. Shop drawings, coordination drawings and product data as specified.

C. Sections for Equipment and Systems.
1. Content for each unit of equipment and system as appropriate:
    a. Description of unit and component parts
        1) Function, normal operating characteristics, and limiting conditions
        2) Performance curves, engineering data and tests
        3) Complete nomenclature and commercial number of replaceable parts.
    b. Operating procedures:
        1) Start up, break-in, routine and normal operating instructions.
        2) Regulation, control, stopping, shut down and emergency instructions.
        3) Summer and winter operating instructions.
        4) Special operating instructions.
    c. Maintenance procedures:
        1) Routine operations
        2) Guide to trouble-shooting.
        3) Disassembly, repair and reassembly.
        4) Alignment, adjusting and checking.
        5) Routine service based on operating hours.
    d. Servicing and lubrication schedule. List of lubricants required.
    e. Manufacturer's printed operating and maintenance instructions.
    f. Description of sequence of operation by control manufacturer.
    g. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
        1) Predicted life of part subject to wear.
        2) Items recommended to be stocked as spare parts.
    h. As installed control diagrams by controls manufacturer.
    i. Complete equipment internal wiring diagrams.
    j. Each Contractor's coordination drawings.
    k. As installed color coded piping diagrams.
    l. Charts of valve tag number, with location and function of each valve.
    m. List of original manufacturer's spare parts and recommended quantities to be maintained in storage.
    n. Other data as required under pertinent sections of the specifications.
2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.

3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications.
4. Provide complete information for products specified in Division 21.
5. Provide certificates of compliance as specified in each related section.
6. Provide start up reports as specified in each related section.
7. Provide signed receipts for spare parts and material.
8. Provide training report and certificates.
9. Provide backflow preventer certified test reports.

END OF SECTION

SECTION 21 05 00

FIRE PROTECTION GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Except as modified in this Section, General Conditions and Supplementary Conditions, applicable provisions of the General Requirements, and other provisions and requirements of the contract documents apply to work of Division 21 Fire Sprinkler Systems.

B. Applicable provisions of this section apply to all sections of Division 22, Plumbing.

1.2 CODE REQUIREMENTS AND FEES

A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.

B. Plumbing work shall comply with applicable inspection services:
1. Underwriters Laboratories
2. National Fire Protection Association
3. State Health Department
4. Local Municipal Building Inspection Department
5. Texas Department of Licensing & Regulations (TDLR)
6. Texas Accessibility Standards (TAS Based on ADA)

C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.

D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.

E. Obtain all permits required.

1.3 CONTRACTOR'S QUALIFICATIONS

A. An approved contractor for the work under this division shall be:
1. A licensed specialist in this field and have the personnel, experience, training, skill, and organization to provide a practical working system
2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that has served their Owners satisfactorily for not less than 3 years

1.4 REFERENCE SPECIFICATIONS AND STANDARDS

A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date bids are received. Requirements in reference specifications and standards are minimum for all equipment, material, and work. In instances where specified capacities, size, or other features of equipment, devices, or materials exceed these

minimums, meet specified capacities.

1.5 CONTRACT DRAWINGS

A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

1.6 PROJECT RECORD DOCUMENTS

A. Maintain at the job site a separate set of white prints (blue line or black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various lines, valves, ductwork, traps, equipment, and other pertinent items, as installed. Include flow-line elevation of sewer lines. Record existing and new underground and under slab piping with dimensioned locations and elevations of such piping.

B. At the conclusion of project, obtain without cost to the Owner, erasable mylars of the original drawings and transfer as-built changes to these. Prior to transmittal of corrected drawings, obtain 3 sets of blue-line prints of each drawing, regardless of whether corrections were necessary and include in the transmittal (2 sets are for the Owner's use and one set is for the Architect/Engineer's records). Delivery of these as-built prints and reproducibles is a condition of final acceptance. Provide record drawings on one set each (reproducible Dayrex mylar film positives) and AutoCad 2012 / Revit CAD files on disk (CD Rom).

C. As-Built drawings should indicate the following information as a minimum:
   1. Indicate all addendum changes to documents.
   2. Remove Engineer’s seal, name, address and logo from drawings.
   3. Mark documents RECORD DRAWINGS.
   4. Clearly indicate: DOCUMENT PRODUCED BY
   5. Indicate all changes to construction during construction. Indicate actual routing of all piping, etc. that were deviated from construction drawings.
   6. Correct schedules to reflect (actual) equipment furnished and manufacturer.
   7. During the execution of work, maintain a complete set of drawings and specifications upon which all locations of equipment, ductwork, piping, devices, and all deviations and changes from the construction documents in the work shall be recorded.
   8. Location and size of all ductwork and mechanical piping above ceiling including exact location of isolation of domestic and plumbing valves.
   9. Exact location of all electrical equipment in and outside of the building.
   10. Fire Protection System documents revised to indicate exact location of all sprinkler heads and zone valves.
   11. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
   12. Cloud all changes.

1.7 SPACE REQUIREMENTS

A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.8 RELATION WITH OTHER TRADES

A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements.

B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.

C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them.

D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.

E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under that Division. Determine from the Contractor for the various trades, the Owner, and by direction from the Architect/Engineer, the exact location of all items.

1.9 CONCEALED AND EXPOSED WORK

A. When the word "concealed" is used in connection with insulating, painting, piping, ducts and the like, the work is understood to mean hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is understood to mean open to view.

1.10 GUARANTEE

A. Guarantee work for 1 year from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.11 MATERIAL AND EQUIPMENT

A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.12 NOISE AND VIBRATION

A. Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions at no additional cost. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.13 ACCEPTABLE MANUFACTURERS

A. Manufacturers names and catalog number specified under sections of Division 21 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer will be acceptable on approval. A request for prior approval

of equipment not listed must be submitted ten (10) days before bid due date. Submit complete design and performance data to the Engineer.

1.14 OPERATING TESTS

A. After all plumbing systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect/Engineer. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.15 WARRANTIES

A. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.16 BUILDING CONSTRUCTION

A. It shall be the responsibility of each sub-contractor to consult the Architectural and Engineering drawings, details, and specifications and thoroughly familiarize himself with the project and all job related requirements. Each sub-contractor shall cooperate with the General Contractor to verify that all piping and other items are placed in the walls, furred spaces, chases, etc., so there will be no delays in the job.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 OPENINGS

A. Framed, cast or masonry openings for ductwork, equipment or piping are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.2 HOUSEKEEPING PADS

A. Provide equipment housekeeping pads under all floor mounted and ground mounted plumbing equipment, and as shown on the drawings.

B. Concrete work as specified in Division 3.

C. Concrete pads:
   1. 4" high, rounded edges, minimum 2500 psi unless otherwise indicated on the drawings
   2. Chamfer strips at edges and corner of forms.
   3. Smooth steel trowel finish.
   4. Doweled to existing slab

D. Install concrete curbs around multiple pipe penetrations.

3.3 VANDAL RESISTANT DEVICES

A. Provide a handle for each loose keyed operated valve and hose bibb on the project.

B. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner 2 suitable tools for use with each type of fastener used.

C. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.4 INSTRUCTION OF OWNER'S PERSONNEL

A. Prior to final inspection, conduct an on-site training program to instruct the Owner's operating personnel in the operation and maintenance of the plumbing systems.
   1. Provide the training during the Owner's regular working day.
   2. The Instructors shall each be experienced in their phase of operation and maintenance of building plumbing systems and with the project.

B. Time to be allocated for instructions.
   1. Minimum of 4 hours dedicated instructor time.
   2. 2 hours on each of 2 days.

C. Before proceeding with the on-site training program, submit the program syllabus; proposed time and dates; and other pertinent information for review and approval.
   1. One copy to the Owner.
   2. One copy to the Architect/Engineer.

D. The Owner will provide a list of personnel to receive instructions, and will coordinate their attendance at the agreed upon times.

E. Use the operation and maintenance manuals as the basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.

F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shut down of each item of equipment.

G. Demonstrate equipment functions (both individually and as part of the total integrated system).

H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.

I. Submit a report within one week after completion of the training program that instructions have been satisfactorily completed. Give time and date of each demonstration and hours devoted to the demonstration, with a list of people present.

J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he/she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.

K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

3.5 EQUIPMENT IDENTIFICATION

A. Provide a laminated engraved plastic nameplate on each piece of equipment and starter.
   1. Designation approved by Architect/Engineer.
   2. Equipment includes, but is not limited to, water heaters, pumps, boilers and utility controllers.
   3. Submit schedule of equipment to be included and designations.

B. Provide nameplates with 1/2" high letters and fastened with epoxy or screws.

3.6 OBSTRUCTIONS

A. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
   1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
   2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.

B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.7 PROTECTION

A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

END OF SECTION

SECTION 21 05 10

FIRE PROTECTION CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Contract quality control including workmanship, manufacturer's instructions and demonstrations.

1.2 QUALITY CONTROL PROGRAM

A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents.

1.3 WORKMANSHIP

A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.

B. Perform work by persons qualified to produce workmanship of specified quality.

C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.

D. Provide finishes to match approved samples. All exposed finishes shall be approved by the Architect. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

A. Comply with instructions in full detail, including each step in sequence.

B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

A. When required in individual Specification Sections, manufacturer shall provide qualified personnel to observe:
   1. Field conditions.
   2. Condition of installation.
   3. Quality of workmanship.
   4. Start-up of equipment.
   5. Testing, adjusting, and balancing of equipment.

B. Representative shall make written report of observations and recommendations to Architect / Engineer.

PART 2 - PRODUCTS

2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS.

PART 3 - EXECUTION

3.1 PROTECTION OF EQUIPMENT

A. Do not deliver equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the Contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.

B. Adequately protect equipment from damage after delivery to the project. Cover with heavy tarpaulins, drop cloths or other protective coverings as required to protect from plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion.

END OF SECTION

SECTION 21 05 12

FIRE PROTECTION SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Prepare submittals as required by Division 1.

B. The term submittal, as used herein, refers to all:
1. Shop Drawings
2. Coordination Drawings
3. Product data

C. Submittals shall be prepared and produced for:
1. Distribution as specified
2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.

B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.

C. Identify field dimensions; show relationship to adjacent features, critical features, work, or products.

D. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

1.3 COORDINATION DRAWINGS

A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: ¼” = 1’-0”.

B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation, and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.

C. For each mechanical room and for each outside equipment pad where equipment is located, submit plan and elevation drawings. Show:
1. Actual mechanical equipment and components to be furnished
2. Service clearance
3. Relationship to other equipment and components
4. Roof drains and leader piping
5. Fire protection piping and equipment

D. Identify field dimensions. Show relation to adjacent or critical features of work or products.

E. Related requirements:
   1. Ductwork shop drawings
   2. Coordination drawing specified in Division 26

F. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

G. Gas piping sketch indicating proposed location of piping prior to proceeding with the installation.

1.4 PRODUCT DATA AND INSTALLATION INSTRUCTION

A. Submit only pages which are pertinent to the project. All options which are indicated on the product data shall become part of the contract and shall be required whether specified are not.

B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.

C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.

D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.

E. Mark up a copy of the specifications for the product. Indicate in the margin of each paragraph the following: “Comply, ”Do Not Comply”, or “Not Applicable”. Explain all “Do Not Comply” statements.

F. Provide a separate transmittal for each submittal item. Transmittals shall indicate product by specification section name and number. Separate all submittals into appropriate specification section number. Do not combine specification sections.

1.5 MANUFACTURERS INSTRUCTIONS

A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up, adjusting, calibrating, balancing and finishing.

1.6 CONTRACTOR RESPONSIBILITIES

A. Review submittals prior to transmittal.

B. Determine and verify:
   1. Field measurements
   2. Field construction criteria
   3. Manufacturer's catalog numbers
   4. Conformance with requirements of Contract Documents

C. Coordinate submittals with requirements of the work and of the Contract Documents.

D. Notify the Architect / Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.

E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect / Engineer's acceptance.

F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect / Engineer reviews submittals or not.

G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect / Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations on reviewed documents.

H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
   1. Proper sizes and capacities
   2. That the item will fit in the available space in a manner that will allow proper service
   3. Construction methods, materials and finishes

I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

1.7 SUBMISSION REQUIREMENTS

A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.

B. Number of submittals required:
   1. Shop Drawings and Coordination Drawings: Submit one reproducible transparency and three opaque reproductions.
   2. Product Data: Submit the number of copies which the contractor requires, plus those which will be retained by the Architect / Engineer.

C. Accompany submittals with transmittal letter, in duplicate, containing:
   1. Date
   2. Project title and number
   3. Contractor's name and address
   4. The number of each Shop Drawing, Project Datum and Sample submitted
   5. Other pertinent data

D. Submittals shall include:
   1. The date of submission
   2. The project title and number
   3. Contract Identification
   4. The names of:
      a. Contractor
      b. Subcontractor
      c. Supplier
      d. Manufacturer
   5. Identification of the product
   6. Field dimensions, clearly identified as such
   7. Relation to adjacent or critical features of the work or materials
   8. Applicable standards, such as ASTM or federal specifications numbers
   9. Identification of deviations from contract documents

10. Suitable blank space for General Contractor and Architect / Engineer stamps
11. Contractor's signed and dated Stamp of Approval

E. Coordinate submittals into logical groupings to facilitate interrelation of the several items:
   1. Finishes which involve Architect / Engineer selection of colors, textures or patterns
   2. Associated items which require correlation for efficient function or for installation

1.8 SUBMITTAL SPECIFICATION INFORMATION

A. Every submittal document shall bear the following information as used in the project manual:
   1. The related specification section number
   2. The exact specification section title

B. Submittals delivered to the Architect / Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.9 RESUBMISSION REQUIREMENTS

A. Make re-submittals under procedures specified for initial submittals.
   1. Indicate that the document or sample is a re-submittal
   2. Identify changes made since previous submittals

B. Indicate any changes which have been made, other than those requested by the Architect / Engineer.

1.10 CONTRACTOR'S STAMP OF APPROVAL

A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.

B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect / Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.

C. Do not deliver any submittals to the Architect / Engineer that do not bear the Contractor's stamp of approval and signature.

D. Submittals delivered to the Architect / Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.11 ARCHITECT / ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

A. The Architect / Engineer will:
   1. Review identified submittals with reasonable promptness and in accordance with schedule

2. Affix stamp and initials or signature, and indicate requirements for re-submittal or approval of submittal
3. Return submittals to Contractor for distribution or for resubmission

B. Review and approval of submittals will not extend to design data reflected in submittals which is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.

C. Architect / Engineer's review and approval is only for conformance with the design concept of the project and for compliance with the information given in the contract.
1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.

D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

1.12 SUBSTITUTIONS

A. Do not make requests for substitution employing the procedures of this Section.

B. The procedure for making a formal request for substitution is specified in Div. 1.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 21 05 13

ELECTRICAL PROVISIONS OF FIRE PROTECTION WORK

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Electrical provisions to be provided as fire protection work are indicated in other Division 21 sections, on drawings, and as specified.

B. Types of work, normally recognized as electrical but provided as fire protection, specified or partially specified in this Section, include but are not necessarily limited to the following:
   1. Motors for fire protection equipment.
   2. Starters for motors of fire protection equipment, but only where specifically indicated to be furnished integrally with equipment.
   3. Wiring from motors to disconnect switches or junction boxes for motors of fire protection equipment, but only where specifically indicated to be furnished integrally with equipment.
   4. Wiring of field-mounted float control switches, flow control switches, and similar fire protection-electrical devices provided for fire protection systems, to equipment control panels.
   5. Pipe heat tracing.

C. Refer to Division 21 sections for specific individual fire protection equipment electrical requirements.

F. Refer to Division 26 sections for motor starters and controls not furnished integrally with fire protection equipment.

G. Refer to Division 26 sections for junction boxes and disconnect switches required for motors and other electrical units of fire protection equipment.

1.2 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to work of this Section.

1.3 QUALITY ASSURANCE

A. Wherever possible, match elements of electrical provisions of fire protection work with similar elements of electrical work specified in Division 26 sections for electrical work not otherwise specified.

B. For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards for definitions of terminology. Comply with National Electrical Code (NFPA 70) for workmanship and installation requirements.

1.4 SUBMITTALS

A. Include in listing of motors, voltage, notation of whether motor starter is furnished or installed integrally with motor or equipment containing motors.

PART 2 - PRODUCTS

2.1 MOTORS

A. Provide motors for fire protection equipment manufactured by one of the following:
   1. Baldor Electric Company.
   2. Century Electric Div., Inc.
   3. General Electric Co.
   4. Louis Allis Div.; Litton Industrial Products, Inc.
   5. Lincoln Electric
   6. Marathon Electric Mfg. Corp.
   7. Reliance Electric Co.
   8. Westinghouse Electric Corp.

B. Motor Characteristics. Except where more stringent requirements are indicated, and except where required items of fire protection equipment cannot be obtained with fully complying motors, comply with the following requirements for motors of fire protection work:

C. Temperature Rating. Rated for 40°C environment with maximum 50°C temperature rise for continuous duty at full load (Class A Insulation).

D. Provide each motor capable of making starts as frequently as indicated by automatic control system, and not less than 5 starts per hour for manually controlled motors.

E. Phases and Current Characteristics. Provide squirrel-cage induction polyphase motors for 3/4hp and larger, and provide capacitor-start single-phase motors for 1/2hp and smaller, except 1/6hp and smaller may, at equipment manufacturer's option, be split-phase type. Coordinate current characteristics with power specified in Division 26 sections, and with individual equipment requirements specified in other Division 21 requirements. For 2-speed motors provide 2 separate windings on polyphase motors. Do not purchase motors until power characteristics available at locations of motors have been confirmed, and until rotation directions have been confirmed.

F. Service Factor. 1.15 for polyphase motors and 1.35 for single-phase motors.

G. Motor Construction. Provide general purpose, continuous duty motors, Design "B" except "C" where required for high starting torque.
   1. Frames. NEMA #56.
   2. Bearings are to be ball or roller bearings with inner and outer shaft seals, regreasable except permanently sealed where motor is inaccessible for regular maintenance. Where belt drives and other drives produce lateral or axial thrust in motor, provide bearings designed to resist thrust loading. Refer to individual section of Division 21 for fractional-hp light-duty motors where sleeve-type bearings are permitted.
   3. Except as indicated, provide open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation, and provide guarded drip-proof motors where exposed to contact by employees or building occupants. Provide weather-protected Type I for outdoor use, Type II where not housed. Refer to individual sections of Division 21 for other enclosure requirements.
   4. Provide built-in thermal overload protection and, where indicated, provide internal sensing device suitable for signaling and stopping motor at starter.
   5. Noise Rating: Provide "Quiet" rating on motors.

H. All motors shall be premium efficiency.

2.2 EQUIPMENT FABRICATION

A. Fabricate fire protection equipment for secure mounting of motors and other electrical items included in work. Provide either permanent alignment of motors with equipment, or adjustable mountings as applicable for belt drives, gear drives, special couplings and similar indirect coupling of equipment. Provide safe, secure, durable, and removable guards for motor drives. Arrange for lubrication and similar running-maintenance without removal of guards.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motors on motor mounting systems in accordance with motor manufacturer's instructions, anchored to resist torque, drive thrusts, and other external forces inherent in fire protection work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.

B. Verify voltage with Electrical Plans.

END OF SECTION

SECTION 21 05 14

FIRE PROTECTION ALTERATIONS PROJECT PROCEDURES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Inspect and service existing equipment and materials that are to remain or to be reused.

B. Disposal of equipment, materials, or housekeeping pads to be abandoned. Prior to disposal, the Contractor shall verify with the Owner what is to be salvaged by the Owner and what is to become the property of the Contractor.

C. Handling of equipment and materials to be removed.

1.2 QUALITY ASSURANCE

A. Coordination with the Owner prior to the disconnection or shutdown of existing equipment, or to the modification of existing operational systems.

1.3 CONTRACT DRAWINGS

A. There is the possibility that existing conditions and devices are affected by the work indicated on the drawings and called for in the specifications (project manual) that do not appear on the drawings. It is the Contractor's responsibility to visit the site and determine all of the existing conditions and to consider these existing conditions when making and presenting a proposal, to have a complete proposal.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Material used to upgrade and repair existing equipment shall conform to that specified.

B. Material used to upgrade and repair existing equipment shall not void existing warranties or listings of the equipment to be upgraded or repaired.

C. Material used to upgrade and repair existing equipment shall be new and shall be of the same manufacturer of the existing equipment, shall be acquired through the existing original equipment manufacturer's approved distribution channels, shall have manufacturer's warranties for the new material being used, and shall be listed for the use intended.

PART 3 - EXECUTION

3.1 INSPECTION

A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be inspected for damaged or missing parts. Contractor shall notify the Architect/Engineer, in writing, accordingly.

B. If using materials specified or shown on the drawing voids or diminishes the warranty or operation of remaining equipment or systems, the Contractor shall notify the Architect/Engineer, in writing.

C. Verify field measurements, above and underground piping connections and flows.

D. Demolition Drawings are based on casual field observation, and when available, existing record documents. Report discrepancies to Architect before disturbing existing installation, and immediately after such discrepancies are discovered.

E. Field verify existing conditions and actual utility uses prior to final connections. Existing drawings may not have been available for all required information.

3.2 APPLICATION

A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be cleaned and reconditioned, including cleaning of piping systems prior to installation and reuse, or abandon.

B. Material and equipment removed that is not to be salvaged for Owner's use or for reuse on the project shall become the property of the Contractor and be removed from the site.

C. Material or equipment salvaged for Owner's use shall be carefully handled and stored where directed by the Owner or the Architect / Engineer. Relocate material and / or equipment as directed by Owner.

D. Materials and equipment not indicated to be removed or abandoned shall be reconnected to the new system.

E. Materials, equipment and housekeeping pads not to be reused or reconnected shall be removed for Owner’s review and salvaged by Contractor.

F. Prior to start of construction, Contractor shall walk areas to be renovated with Owner to identify and document items to be salvaged for Owner’s use.

G. Clean and repair existing materials and equipment that remain or are to be reused.

H. Contractor shall utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

3.3 SEQUENCE AND SCHEDULE

A. Coordinate utility service outages with Utility Company, Architect and Owner.

B. Provide additional or temporary valves, piping and connections to maintain existing systems in service during construction.

C. Existing Fire Protection Service: Refer to drawings for work in remodeled areas. Where facilities in these areas are to remain in service, any related work to keep the facilities in operation is specified in this Division. Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Maintain acceptable

temperature and humidity control within existing building during renovation activities.

D. Remove and replace existing fire protection systems and appurtenances as occasioned by new or remodeled construction. Re-establish service that may be interrupted by remodeled construction.

E. Refer to other drawings series for work in remodeled areas. Where facilities in these areas are required to remain in service, any related work required to keep these facilities in operation is specified in this Division.

F. Remove and replace existing piping coincident with the construction.

3.4 DEMOLITION AND EXTENSION OF EXISTING FIRE PROTECTION WORK

A. The Contractor shall modify, remove, and/or relocate all materials and items so indicated on the drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain the property of the Owner, and shall be delivered to such destination as directed by the Owner's representative unless they are not wanted, then it will be the responsibility of this Contractor to remove such items and properly dispose of them. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition. The Contractor may, at his discretion, and upon approval of the Owner's representative substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.

B. All items to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean, repair, and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore them to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.

C. When items scheduled for relocation and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner's representative to such items and receive further instructions before removal. Items damaged in repositioning operations are the contractor's responsibility and shall be repaired or replaced by the contractor as approved by the owner's representative, at no additional cost to the Owner.

D. Fire protection piping and appurtenances to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner's representative. Piping not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied-off or disconnected in a safe manner acceptable to the Construction Inspector. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities that must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner's representative hereinbefore specified.

E. Repair adjacent construction and finishes damaged during demolition and extension work.

F. Maintain access to mechanical installations that remain active. Modify installation or provide access panel as appropriate.

G. Extend existing installations using materials and methods compatible with existing fire protection installation, or as specified.

H. Existing fire protection piping and devices found to need additional hangers installed 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 equipment in renovated areas as specified in Section 21 05 00 Fire Protection General Provisions.

END OF SECTION

SECTION 21 10 00

FIRE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Design coordination of sprinkler work with the installations of other trades as shown on their drawings; all mechanical, electrical, plumbing and sprinkler work must fit the space requirements. The sprinkler work shall comply with other Sections of this specification; and fit the structure finishes. The Sprinkler Contractor will comply with all the codes and underwriter authorities, and the requirements for the installation of inside and outside piping; including sprinkler heads, valves, tamper switches, flow switches, hangers and supports, sleeves, fire department connections, inspector test connections, main drain and accessories, signs and any other component parts reasonably incidental to providing a complete protection system. Provide 100 percent coverage for the entire building.

B. A wet system shall be installed in heated areas and dry pipe systems in areas subject to freezing. When heated areas are not available and dry pipe system not used, provide heat tracing and / or insulation installed per NFPA and per local Fire Marshall Requirements, or as indicated on drawings.

C. Furnish all articles of a completed sprinkler system including all materials, labor, tools, equipment, transportation services and supervision fees.

D. The plans provide a riser assembly location at water entry into building for flow switch locations, valve locations (with tamper switches), fire department test assemblies and fire department Siamese connections. These are a guide for subsequent preparation of the Contractor’s detailed installation drawings of the complete fire protection sprinkler system which shall be submitted to the Architect / Engineer for review. Submit only drawings and calculations bearing the approval of the authority having jurisdiction.

E. Do not exceed 52,000 square feet of building for each individual sprinkler system.

F. Install fire protective system identification signs in accordance with NFPA-13, NFPA-14, and NFPA-20

G. It shall be the fire protection installer’s responsibility, prior to bid, to verify pressure at the project site by performing a flow test. Determine if the available static pressure, residual pressure and flow rate will adequately provide the fire extinguishing system with the necessary operating requirements or if a fire pump, storage tank and necessary appurtenances are required. Notify Architect and Engineer if low water flow / pressure condition exist and inform them of all options prior to proceeding.

H. The installation of the entire Sprinkler Systems shall comply with all rules and regulations of the National Board of Fire Underwriters, the Local Building Code, Local Fire Marshall, and Requirements of NFPA Pamphlet 13, and other local authorities exercising jurisdiction.

I. Study the general, structural, electrical and mechanical drawings and specifications, in order to become familiar with the building and details as they apply to the work of this Section. Cooperate with all Trades so that there will be no conflict of space. Plumbing

flow lines, large ductwork HVAC piping and electrical service feeders shall take precedence over Fire Protection work, except where it is absolutely necessary to maintain coverage protection.

J. Provide a water curtain sprinkler system along glazing to create a 1-hour rating, as outlined in NFPA 13. Refer to Architecture plans for locations. Water demand for water curtain shall be added to the ceiling sprinkler water demand at the point of connection, per NFPA 13. Sprinkler heads shall be spaced at 6’-0” o.c., minimum 6 inches and maximum 12 inches from glazing.

1.2 BASIS OF DESIGN

A. National Fire Protection Association (NFPA), latest edition of NFPA 13, Standard for the Installation of Sprinkler Systems.

B. Vertical zone valves installed in horizontal position are not acceptable. All zone valves are to be located at water entry into building and mounted in the vertical riser.

1.3 QUALITY ASSURANCE

A. Sprinkler equipment and installation to be in accordance with recommendations of and approved by local, state and federal fire authorities.

B. Equipment and installation to meet requirements of NFPA No. 13, 14, 20, 24, 25, 70 and 72.

C. Use materials and equipment that are new and of unused, approved by NFPA and as listed in the UL list of "Inspected Fire Protection Equipment and Materials."

1.4 SHOP DRAWINGS

A. Make complete shop drawings and working drawings of equipment furnished, including detailed drawings of piping and sprinkler head locations. Drawings shall show construction details and dimensions of each piece of equipment and work to be installed. The location of all heads shall be as approved. Where additional heads are required to meet NFPA 13, provide at no additional cost.

B. Before the shop drawings are submitted to Architect / Engineer, submit drawings to the jurisdictions for approval. All approvals shall be noted on the drawings or by letter from the departments.

C. The Architect's approval of shop drawings shall not relieve the responsibility of correctly figured dimensions or any errors that may be contained in these drawings. The omission of any material shown on the contract drawings, or specified from the shop drawings, even though approved, shall not relieve the responsibility to furnish and erect them.

D. The drawings show the location of the water entry into building. Install all zone valves at this location. Prepare the sprinkler drawings under the work of this Section.

E. Submit samples of all sprinkler types for approval.

F. Provide flow rates for sprinkler system and for Inspector’s Sprinkler Test Drains.

1.5 ACCEPTABLE MANUFACTURERS

A. Tyco Fire Products
   1. Anvil
   2. Gem
   3. Central

B. Automatic Sprinkler Company of America

C. Potter Roemer, Inc.

D. The Reliable Automatic Sprinkler Company

E. Viking Corporation

F. Victaulic Company of America

G. Grinnell

PART 2 - PRODUCTS

2.1 PIPING AND FITTINGS

A. Above Slab Inside Building
   1. Pipe 2" and Smaller: Schedule 40, black steel pipe conforming to ASTM A 795 or ASTM A135 joined with threaded fittings.
   2. Pipe 2-1/2" and larger, provide ASTM A795 or ASTM A135 UL and FM listed.
      a. Schedule. 40, black steel pipe joined with rolled grooved fittings.

B. Underground within five feet of building. Provide IBR pipe, in building riser, NFPA 24, UL/FM approved. Provide concrete thrust blocks at changes in direction, according to the pipe manufacturer's recommendations.

C. All piping shall be black carbon steel, except in dry systems where pipe shall be galvanized per ASTM A53.

D. Fittings used to join pipe shall be listed fabricated fittings or manufactured in accordance to the material and dimension standards listed in table 6.4.1 NFPA 13 and 2.2.1 NFPA 14.

E. Sprinkler branch tap connections, tees, cross outlet with female threaded or grooved that requires hole drilling of main pipe is not acceptable and will not be allowed.

2.2 SPRINKLER HEAD

A. All sprinklers shall comply with the latest requirements of NFPA 13 with respect to orifice size.

B. All heads shall be UL listed and FM approved, and comply with the latest requirements of NFPA 13 with respect to orifice size unless otherwise noted. Sprinkler heads with “O” ring design shall not be acceptable.

C. Exposed areas:
   1. Standard upright type with brass finish and escutcheon. Provide temperature rating per NFPA 13 and UL/FM approvals.
   2. Tyco Model B, FRB, or approved equal

D. Sidewall applications:
   1. Horizontal sidewall type with brass finishes and chrome escutcheon.
   2. Unfinished areas and recessed with chrome plated escutcheon. Provide temperature rating per NFPA 13 and UL/FM approvals.
   3. Tyco Model B, FRB, or approved equal.

E. Suspended ceilings:
   1. Adjustable drop down deflector type concealed heads with manufacturer painted white cover plate with glass bulb fusible link. Provide temperature rating per NFPA 13 and UL/FM approvals.
   2. Color of plate, selected by Architect
   3. Tyco Series RFII; Series ELOC, or approved equal.

F. Dry sprinklers heads at freezers and coolers
   1. Tyco Model DS-1, DS-2, or approved equal.

G. Sprinklers subject to mechanical injury shall be protected with fusible solder type sprinklers and heavy duty mechanically fastened guards. Provide Sprinkguard “Threadguard” two-piece system threads into fire line fitting; secured with two 5/16 inch bolts and Nylock nuts. Bulb type sprinklers will not be acceptable for these locations.
   1. Storage rooms with exposed structure.
   2. Gymnasiums.
   3. Mechanical and Electrical rooms.
   4. Below exposed stairs.
   5. Exposed structure areas.

H. In Elevator Machine Rooms, ensure shunt trip is incorporated into the fire alarm system as per current code requirements.
   1. Acceptable Manufacturers
      a. Reliable
      b. Grinnell
      c. Viking

H. Systems serving walk-n freezers shall utilize Tyco Model DS-1 or DS-C dry pendent sprinklers. A Model DSB-1 dry sprinkler boot shall be utilized in conjunction with the dry sprinkler to eliminate the requirement for insulation and to stop potential air interchange. Length of dry pendent shall be determined by manufacturer’s recommendation with respect to freezer ambient temperatures expected.

2.3 INSPECTOR’S TEST CONNECTION

A. Provide inspector’s test connection as required by NFPA 13.
   1. Ductile iron module housing with combination sight glass, orifice and bonnet assembly
   2. UL listed
   3. Victaulic No. 718
   4. Tyco or approved equal

B. Do not terminate drain valves and test drains onto sidewalks. Pipe to designated floor sink in mechanical room or route sprinkler test drain piping to specific locations as noted on Plumbing Drawings.

C. Provide flow rates for each Inspector’s Test Drain.

2.4 TAMPER SWITCH / SUPERVISORY SWITCH

A. Tamper switch on each valve
   1. Controlling or shutting off sprinkler system or any portion thereof.
   2. Tamper switch with either one single pole, double throw switch or two single pole, double throw switches as required.
   3. Switch shall be compatible with installed valve for standard mounting.
   4. Potter-Roemer Fig. 6220, 6221, 6222, 6223 or approved equal.

2.5 FLOW SWITCH

A. Vane type flow switch.
   1. Self-contained pneumatic, adjustable retard.
   2. Two, single pole, double throw switches.
   3. Red enamel tamper proof switch housing with flow paddle.
   4. Potter Roemer Model No. 6200, or approved equal.

2.6 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.

2.8 DRY PIPE SYSTEM

A. General: Provide a UL listed and FM approved dry pipe system at areas subject to freezing. System shall consist of a dry pipe valve, air compressor, fusible link type sprinkler heads and all associated trim and piping for a complete operating system.

B. Dry Pipe Valve: Rated for a working pressure of 175 psi, factory hydrostatic tested at 350 psi, supplied with all gauges, valves, strainer, electrical alarm switch, ball drip valve, and drip cup assembly, manufactured by Victaulic Model 756.

C. Air Compressor: Oilless, permanently lubricated, pipe mounted, direct drive, complete with safety relief valve manufactured by Reliable Model A or approved equal. Size of air compressor is determined by volume of dry pipe system. Coordinate power requirement with electrical contractor. Coordinate all wiring required with Fire Alarm System.

D. If the dry pipe system is not used in conjunction with a wet pipe system containing the necessary check valves or backflow preventer, a check valve shall be installed in the dry pipe system at the connection to the water supply.

E. If the dry pipe system is not used in conjunction with a wet pipe system containing a control valve such as a post indicator (PIV) or outside screw & yoke valve (OS&Y), a PIV or OS&Y shall be installed in the system.

F. The dry pipe valve and pipe to the wet supply shall be protected from freezing.

G. Provide an automatic or manual compressed air system capable of restoring normal air pressure to a system in 30 minutes or less.

H. Provide an accelerator when system capacity exceeds 500 gallons.

I. Provide a water motor alarm or electric pressure switch.

J. Provide dry pipe valve trim and pressure gauges.

K. Dry pipe system shall be hydraulically calculated for the hazard being protected.

L. Provide dry pendent type sprinkler heads only when the piping and sprinklers are not in a heated area.

M. Provide a test drain valve sized per NFPA. An inspector's test shall be provided at each system.

N. Slope all piping toward a drain per NFPA 13. A drain shall be provided at all low points.

O. The following accessories shall be provided where required:
   1. Victaulic Series 756.
   2. Viking Model E dry pipe valve with conventional trim.
   3. Viking Model D-1 accelerators.

2.9 GASKETS

A. Use 1/16-inch thick preformed synthetic rubber bonded.

2.10 COUPLINGS

A. Use listed rolled grooved mechanical couplings to engage and lock grooved or shouldered pipe ends and to allow for some angular deflection, contraction and expansion. Coupling consists of ductile iron housing, c-shaped composition sealing gasket and steel bolts. Gasket Material for dry pipe systems shall be silicone and listed for dry pipe service.

2.11 VALVES

A. Use valves suitable for 175 psig WOG.

B. Valves to be UL listed and FM approved.

C. Valve Connections:
   1. Provide valves suitable to connect adjoining piping as specified for pipe joints. Use full line size valves unless noted otherwise.
   2. Screwed ends for pipe sizes 2 inches and smaller.
   3. Flanged ends for pipe sizes 2-1/2 inches and larger.
   4. Solder or screw to solder adapters for copper tubing.
   5. Use grooved body valves with mechanical grooved jointed piping.

D. Gate Valves:
   1. Up to 2 inches, bronze, outside screw and yoke, rising stem, solid wedge, screwed ends, manufactured by: Mueller, or approved equal.

2. Over 2 inches, iron body, bronze trim, outside screw and yoke, rising stem, solid wedge, flanged ends; manufactured by Mueller, or approved equal by Nibco, Grinnell, Stockham and Victaulic.

E. Check Valves:
1. Up to 2 inch, bronze, regrind bronze swing disk, solder or screwed ends; 200 WOG, manufactured by Mueller, or approved equal.
2. Over 2 inch, iron body bronze trim, swing disk, regrind – renew bronze disk and seat, flanged ends; 200 WOG, manufactured by Mueller, or approved equal by Nibco, Grinnell, Stockham and Victaulic.

F. Butterfly Valve: Lug body style, bubble-tight shutoff, cast iron body, ASTM B 148 bronze disk, with integral tamper switch, manufactured by Anvil Model No. 8000 FP, or approved equal.

G. Freestanding Indicating Post: Install adjustable indicating post and valve outside building where shown on Civil drawings, consisting of UL/FM, non-rising stem gate valve and indicating post. Gate valve shall be iron body, non-rising stem, bronze mounted. Indicator flange, 175-psi non-shock rating, flanged end. Indicator shall be UL/FM approved cast iron body, Plexiglas window and 18-inch adjustment span with handle and tamper switch wired to main fire alarm control panel, manufactured by Mueller, Valve No. A-2052, Indicating Post No. A20800, or approved equal.

H. Wall post-adjustable indicating valve: Outside building at water entry location into building, consisting of UL/FM, non-rising stem gate valve and indicator. Gate valve shall be iron body, non-rising stem, bronze mounted. Indicator flange, 175-psi non-shock rating, flanged end. Indicator shall be UL/FM approved cast iron body, Plexiglas window and 18-inch adjustment span with handle, manufactured by Mueller, Valve No. A-2052, Indicating Post No. A20800, or approved equal.

2.12 ELECTRIC ALARM BELL

A. 10-inch round red enamel steel bell with electrically operated vibrating outdoor alarm bell, UL listed, red enamel steel, manufactured by Simplex, or approved equal.

2.13 GAUGES

A. Gauges shall be bourdon tube type with minimum 4-1/2 inch dial and die cast aluminum case with screwed ring and black enamel finish. The movement shall be all stainless steel with Grade A phosphor bronze bourdon tube, brazed at socket and tip. The accuracy of the gauge shall be within one-half of one percent of the scale range. The pointer shall be the micrometer adjustment type recalibrated from the front. Pressure and compound gauges shall have suitable scale ranges and graduations. Suitable for temperatures up to 120 degrees F.

B. Gauges shall have ¼ inch connections and be mounted with combination stop / snubber needle valve with suitable pressure rating. Scale ranges: 0-200 psi.

C. Gauge range shall be such that system normal operating pressure falls with 25 percent and 75 percent of the full-scale range.

D. Pressure scale graduations shall read in psig. Figure intervals shall be in – 20 psig increments, with minor divisions in 2 psig increments.

E. The accuracy of the gauge shall be at least 0.5 percent of the scale range. Gauge shall be made in accordance with ASME B40.1 accuracy grade 2A.

F. Manufactured by:
1. Trerice Model No. 4500 Series
2. Ashcroft
3. Marsh
4. Weksler

2.14 SPARE SPRINKLER HEAD BOX

A. Provide baked enamel steel box to store 36 sprinkler heads (Minimum of 3 of each type used) for emergency replacement. Provide sprinkler wrench.

2.15 ALARM CHECK VALVE

A. Provide UL listed check valve.
1. Variable for City Supplied systems pressure trim set.
2. Constant for Fire Pump Systems pressure trim set.
3. Tyco AV-1 or approved equal by Reliable, Grinnell and Viking.

PART 3 - EXECUTION

3.1 DESIGN

A. Design, spacing of sprinkler heads and selection sizes shall conform to the requirements of NFPA 13 for the indicated occupancy.

B. Uniform discharge density design shall be based on hydraulic calculations using the method outlined in NFPA 13. Density of discharge from sprinkler heads shall conform to NFPA 13.

C. Friction losses in pipe will be based on a value of “C” = 120 in the Hazen and Williams formula.

D. Design and install the system so that no part will interfere with doors, windows, heating, mechanical, lighting or electrical equipment. Do not locate sprinkler heads closer than 3 feet to lighting fixtures or other obstructions.

3.2 LOCATION

A. Heads shown, if indicated on reflected ceiling plans, are an integral part of the ceiling design. Where heads are not shown or indicated, locate them in the exact center of acoustical ceiling tile unless noted otherwise. In rooms with monolithic plaster or gypsum drywall ceilings, locate the sprinkler heads symmetrically arranged with respect to both axes of the room. Locate sprinkler heads in relation to specialty ceiling elements such as slats, ribs, panels, grids, etc., if not shown on the drawings. Generally, locate heads in the exact center of, or spaced between, such elements. Center heads in corridors.

B. Locate heads as may be required for coordinated ceiling pattern, even through number of heads exceed minimum code requirements.

C. Sprinkler heads located in utility or mechanical rooms, penthouses, service corridors, or other such spaces not subject to public view need not be centered in ceiling patterns and may use a straight drop from branch line.

D. Install a water curtain sprinkler system along glazing to create a 1-hour rating, as outlined in NFPA 13. Refer to plans for locations. Water demand for water curtain shall be added to the ceiling sprinkler water demand at the point of connection, per NFPA 13. Sprinkler heads shall be spaced at 6'-0" on center, minimum 6 inches and maximum 12 inches from glazing.

E. Where glazing shall be installed in 2-hour fire rated assemblies, the Tyco Window sprinkler shall be utilized as outlined in the ICC Legacy report equivalency requirements. Any glazing requiring fire exposure protection shall also utilize the Tyco window sprinklers.

3.3 PREPARATION

A. Ream pipes and tubes, clean off scale, rust, oxide and dirt, inside and outside, before assembly. Remove welding slag or other foreign material from piping.

B. Pipe beveled each end, per approved procedures.

C. Hammer clean and flush out piping after welding to remove scale, welding slag and other debris.

3.4 CONNECTION

A. Make screwed joints with square, clean full cut standard taper pipe threads. Ream after cutting and threading. Red lead and linseed oil or other approved non-toxic joint compound applied to male threads only.

B. Nipples: Shoulder type; extra heavy where less than 1-1/2 inch is unthreaded.

C. Clamp cast iron water pipe at fittings with ¾ inch rods and properly anchor and support.

D. Use grooved mechanical couplings and mechanical fasteners only in accessible locations.

3.5 COORDINATION

A. Coordinate the installation schedule for this work with the construction schedule for the Work to ensure orderly progress with minimum delay.

B. Coordinate interface of fire sprinkler system with the work of other trades to ensure proper and adequate provision for the installation and connection of this system.

C. Coordinate location and quantity of Siamese connections required for fire department connection with Architect and local fire officials.

3.6 SURFACE CONDITIONS

A. Before starting each stage of the fire sprinkler systems installation, inspect the installed work of other trades and determine that work is complete enough to allow

installation to begin. Ensure that work of other trades has been installed in a manner to permit work of this Section in accordance with approved design.

3.7 INSTALLATION

A. Run piping concealed above furred ceilings and in joists to minimize obstructions. Expose only heads.

B. Protect sprinkler heads against mechanical injury with heavy duty bolt-on guards.

C. Locate system drains and inspector's test connections to drain to floor drain inside mechanical rooms or other readily accessible areas not requiring access through ceiling. Coordinate sprinkler system drain flow rates with plumbing system drainage capacities.

01. Sprinkler Contractor shall note that all sprinkler test drains, in all locations, shall be routed back to the nearest mechanical room and terminated within a floor sink or trench. All valve locations and pipe routing shall be in an accessible location. By no means shall it be acceptable for the termination to occur in other locations unless specifically noted on the MEP plans. Do not terminate drains and test drains onto sidewalks.

D. Where low points or drains occur above ceilings or in otherwise finished spaces, furnish drain valve with brass cap and chain.

E. Locate outside alarms on wall of building and coordinate with Architect.

F. Fire pump and all accessories shall be tested in accordance with NFPA 20 and the local Fire Marshall and/or all other authorities having jurisdiction.

G. Provide on interior wall near sprinkler valve, cabinet containing extra sprinkler heads of each type and wrench suitable for each head type.

H. Provide a minimum 18-inch radius swing joint for each drop to sprinkler heads located in ceilings. NO FLEXIBLE SPRINKLER HEAD CONNECTORS ALLOWED.

I. Install pipe markers to identify fire protection.

J. Provide shield or deflector for sprinklers or equipment where electrical switchgear, switchboards and motor control centers are in sprinkler protected spaces.

K. Install fire 2-1/2 inch department valve, maximum 5 feet above floor, complying with NFPA 14.

L. During construction, make one standpipe outlet available on each floor without delay, for fire department use.

M. Provide 3-way standpipe outlets above roof.

N. Provide pressure gauges at the top of each standpipe as detailed on the drawings.

O. Provide drain for each standpipe.

P. Install valves with stems upright or horizontal, not inverted.

Q. Sprinkler heads shall be installed above and below ductwork over 48 inches wide, in exposed areas, per NFPA 13.

R. Install the complete fire sprinkler system in accordance with the approved shop drawings.

S. Perform piping installation in accordance with the provisions of the specifications, including furnishing of required sleeves for fire sprinkler system pipes passing through rated walls, floors, and other parts of the building. Provide scheduled 40 galvanized pipe sleeve for concrete or CMU penetrations. Furnish size required for fireproofing and or insulation. Furnish and install split wall plates and chrome plated escutcheons for exposed fire sprinkler system pipes. Where pipes pass through concrete floors, furnish and install wrought iron or steel pipe sleeves made flush with the ceiling below and extending 2" above the finished floor.

T. Do not cut or make holes in any part of the building except where shown on the approved shop drawings.

U. Furnish and install, next to the sprinkler riser main, a print sheet protected by glass or a transparent plastic cover, giving brief instructions regarding control, emergency procedure, and other data required by NFPA #13. For hydraulically designed sprinkler systems, a placard is to be permanently attached to the riser indicating the location, and the basis of design (discharge density and system demand).

V. Do not install exposed piping below structure in public area.

W. Provide heat tracing and insulation on wet piping systems exposed to freezing when not installed in a heated space or installed by other acceptable methods of maintaining the piping from freezing. Installation of heat tracing and insulation shall be in accordance with the latest edition of NFPA 13 and the local code authorities. Coordinate electrical requirements with Division 26.

X. Do not intrude onto or overlap into sidewalk areas with (FDC) Fire Department Connection.

3.8 SECURING AND SUPPORTING

A. Support piping to maintain line and grade, with provision for expansion and contraction. Use approved hangers per NFPA 13 connected to structural members of the building. Do not support piping from other piping or structural joist bridging. Note that saddle clamps are not allowed and not approved for supporting piping.

B. Provide supports both sides of elbows for pipe 6" and larger.

C. Support vertical risers with steel strap pipe clamps of approved design and size, supported at each floor. Support piping assemblies in chases so they are rigid and self-supported before the chase is closed.

D. Support spacing: As recommended by the project structural engineer and support manufacturer, but not more than listed below. Not to exceed spacing requirements of smallest pipe.

Pipe Size	Steel Max. Support Spacing, Feet	Minimum Rod Diameter, Inches
1" & smaller	6	3/8

1-1/4" & 1-1/2"	8	3/8
2"	10	3/8
3"	10	1/2
4" & 5"	10	5/8
6" and above	10	3/4

3.9 PIPE SUPPORTS

A. Provide sprinkler piping supports per NFPA 13.

3.10 PIPE SLEEVES

A. Sleeves through masonry and concrete construction:
   1. Fabricate sleeves of Schedule 40 galvanized steel pipe.
   2. Size sleeve large enough to allow for movement due to expansion and to provide continuous insulation.

B. Sleeves through gypsum wall construction.
   1. Fabricate sleeves of 16 gauge galvanized sheet metal.

C. Sleeves through elevated slab construction.
   1. Fabricate sleeves of Schedule 40 galvanized steel pipe with welded center flange in floor.

D. Extend each sleeve through the floor or wall. Cut the sleeve flush with each wall surface. Sleeves through floors shall extend 2” above floor lines for waterproofing purposes. Slab on grade floors shall not be sleeved except where penetrating waterproofing membrane or insect control is required.

E. Caulk sleeves water and airtight. Seal annular space between pipes and sleeves with mastic compound to make the space water and 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 CLEANING OF PIPING SYSTEMS

A. General cleaning of piping systems. Purge pipe of construction debris and contamination before placing the systems in service. Provide and install temporary connections as required to clean, purge and circulate.

3.12 FLUSHING AND TESTING

A. Testing and flushing of installation of sprinkler system shall be in accordance with NFPA 13, and NFPA 25.

B. Flush sprinkler piping in accordance with NFPA 13. Additionally, flush all alarm valves, and all main piping up to valve.

C. In addition to NFPA 13 required tests, provide flow switch test and tamper switch test for each device, and verify alarm valve operation.

D. All tests shall be witnessed by Architect / Engineer. Contractor shall notify Architect / Engineer 7 working days in advance.

3.13 EXCAVATING, TRENCHING, AND BACKFILLING

A. Perform excavation, trenching, and backfilling for this portion of the work in accordance with the specifications.

3.14 PIPE MARKERS

A. Identify interior main piping and exposed in mechanical room piping 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. 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.

C. Pipe markers shall meet or exceed the specifications of the ASME A13.1 “Scheme for Identification of Piping Systems”.

3.15 TESTING AND ACCEPTANCE

A. Prior to connecting to the overhead sprinkler piping, flush the underground main. Secure required approvals of the flushing operations.

B. Upon completion of the fire sprinkler system installation, test and retest the complete installation and make corrections as necessary to obtain acceptance by the Fire Marshall and/or any other authority having jurisdiction. Furnish test equipment and personnel required.

3.16 TRAINING

A. At a time mutually agreed upon, provide 4 hours of instruction to the Owner’s designated personnel on the operation and maintenance of the automatic sprinkler system and associated equipment. Owner’s Operation and Maintenance Manual prepared for this project shall be used during the instruction.

END OF SECTION

SECTION 22 01 00

PLUMBING OPERATING AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Compilation product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare operating and maintenance data as specified.

B. Instruct Owner's personnel in operation and maintenance of equipment and systems.

C. Submit three copies of complete manual in final form.

1.2 SUBMITTALS

A. Thirty (30) days after the Contractor has received the final scheduled identified submittals bearing the Architect/Engineer's stamp of acceptance (including resubmittals), submit for review one copy of the first draft of the Operating and Maintenance Manual. This copy shall contain as a minimum:
   1. Table of Contents for each element.
   2. Contractor information.
   3. All submittals, coordination drawings and product data, reviewed by the Architect/Engineer; bearing the Architect/Engineer's stamp of acceptance. (When submittals are returned from Engineer "Correct as Noted", corrected inserts shall be included.)
   4. All parts and maintenance manuals for items of equipment.
   5. Warranties (without starting dates)
   6. Certifications that have been completed. Submit forms and outlines of certifications that have not been completed.
   7. Operating and maintenance procedures.
   8. Form of Owner's Training Program Syllabus (including times and dates).
   9. Control operations/equipment wiring diagrams.
   10. Other required operating and maintenance information that are complete.

B. Copy will be returned to the Contractor within 15 days with comments for corrections.

C. Submit completed manuals in final electronic form to the Architect/Engineer one day after substantial completion, and prior to Owner's instructions. Include all specified data, test and balance reports, drawings, dated warranties, certificates, reports, along with other materials and information.

D. The Architect/Engineer will review the manuals for completeness within fifteen (15) days.

E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Architect / Engineer. The manuals will not be retransmitted.

F. Completed electronic manuals will be delivered to the Owner.

PART 2 - PRODUCTS

2.1 BINDERS

A. Commercial quality black three-ring binders with clear overlay plastic covers.

B. Minimum ring size: 1".
Maximum ring size: 3".

C. When multiple binders are used, correlate the data into related groupings.

D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

3.1 OPERATION AND MAINTENANCE MANUAL

A. Form for Manuals:
1. Prepare data in form of an instructional manual for use by Owner's personnel.
2. Format:
   a. Size: 8-1/2" x 11".
   b. Text: Manufacturer's printed data or neatly typewritten.
3. Drawings:
   a. Provide reinforced punched binder tab and bind in text.
   b. Fold larger drawings to size of text pages.
4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
   a. Title of Project
   b. Identity of separate structures as applicable.
   c. Identity of general subject matter covered in the manual.
6. Binder as specified.

B. Content of Manual:
1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
   a. Contractor, name of responsible principal, address and telephone number.
   b. A list of each product required to be included, indexed to content of the volume.
   c. List with each product, name, address and telephone number of:
      1) Subcontractor or installer.
      2) Maintenance contractor as appropriate.
      3) Identify area of responsibility of each.
      4) Local source of supply for parts and replacement.
   d. Identify each product by product name and other identifying symbols as set forth in Contract Documents.
2. Product Data:
   a. Include those sheets pertinent to the specific product.
   b. Annotate each sheet to:
      1) Identify specific product or part installed.
      2) Identify data applicable to installation.
      3) Delete references to inapplicable information. (All options not supplied with equipment shall be marked out indicated in some manner.
3. Drawings:
   a. Supplement product data with drawings as necessary to illustrate:

1) Relations of component parts of equipment and systems.
2) Control and flow diagrams.

b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.

c. Do not use Project Record Documents as maintenance drawings.

4. Written text, as required to supplement product data for the particular installation:
   a. Organize in consistent format under separate headings for different procedures.
   b. Provide logical sequence of instructions for each procedure.
5. Copy of each warranty, bond and service contract issued.
   a. Provide information sheet for Owner's personnel, giving:
      1) Proper procedures in event of failure.
      2) Instances that might affect validity of warranties or bonds.
6. Shop drawings, coordination drawings and product data as specified.

C. Sections for Equipment and Systems.
1. Content for each unit of equipment and system as appropriate:
   a. Description of unit and component parts.
      1) Function, normal operating characteristics, and limiting conditions.
      2) Performance curves, engineering data and tests.
      3) Complete nomenclature and commercial number of replaceable parts.
   b. Operating procedures:
      1) Start up, break-in, routine and normal operating instructions.
      2) Regulation, control, stopping, shut down and emergency instructions.
      3) Summer and winter operating instructions.
      4) Special operating instructions.
   c. Maintenance procedures:
      1) Routine operations
      2) Guide to trouble-shooting.
      3) Disassembly, repair and reassembly.
      4) Alignment, adjusting and checking.
      5) Routine service based on operating hours.
   d. Servicing and lubrication schedule. List of lubricants required.
   e. Manufacturer's printed operating and maintenance instructions.
   f. Description of sequence of operation by control manufacturer.
   g. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
      1) Predicted life of part subject to wear.
      2) Items recommended to be stocked as spare parts.
   h. As installed control diagrams by controls manufacturer.
   i. Complete equipment internal wiring diagrams.
   j. Each Contractor's coordination drawings.
   k. As installed color coded piping diagrams.
   l. Charts of valve tag number, with location and function of each valve.
   m. List of original manufacturer's spare parts and recommended quantities to be maintained in storage.
   n. Other data as required under pertinent sections of the specifications.
2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications.
4. Provide complete information for products specified in Division 22.

5. Provide certificates of compliance as specified in each related section.
6. Provide start up reports as specified in each related section.
7. Provide signed receipts for spare parts and material.
8. Provide training report and certificates.
9. Provide backflow preventer certified test reports.
10. Provide gas piping pressure test reports.

END OF SECTION

SECTION 22 05 00

PLUMBING GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of the General Requirements, and other provisions and requirements of the contract documents apply to work of Division 22 Plumbing.

B. Applicable provisions of this section apply to all sections of Division 22, Plumbing.

1.2 CODE REQUIREMENTS AND FEES

A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.

B. Plumbing work shall comply with applicable inspection services:
1. Underwriters Laboratories
2. National Fire Protection Association
3. State Health Department
4. Local Municipal Building Inspection Department
5. Texas Department of Licensing & Regulations (TDLR)
6. Texas Accessibility Standards (TAS Based on ADA)

C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.

D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.

E. Obtain all permits required.

1.3 CONTRACTOR'S QUALIFICATIONS

A. An approved contractor for the work under this division shall be:
1. A licensed specialist in this field and have the personnel, experience, training, skill, and organization to provide a practical working system
2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that has served their Owners satisfactorily for not less than 3 years

1.4 REFERENCE SPECIFICATIONS AND STANDARDS

A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date bids are received. Requirements in reference specifications and standards are minimum for all equipment, material, and work. In instances where specified capacities, size, or other features of equipment, devices, or materials exceed these minimums, meet specified capacities.

1.5 CONTRACT DRAWINGS

A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

1.6 PROJECT RECORD DOCUMENTS

A. Maintain at the job site a separate set of white prints (blue line or black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various lines, valves, ductwork, traps, equipment, and other pertinent items, as installed. Include flow-line elevation of sewer lines. Record existing and new underground and under slab piping with dimensioned locations and elevations of such piping.

B. At the conclusion of project, obtain without cost to the Owner, erasable mylars of the original drawings and transfer as-built changes to these. Prior to transmittal of corrected drawings, obtain 3 sets of blue-line prints of each drawing, regardless of whether corrections were necessary and include in the transmittal (2 sets are for the Owner's use and one set is for the Architect/Engineer's records). Delivery of these as-built prints and reproducibles is a condition of final acceptance. Provide record drawings on one set each (reproducible Dayrex mylar film positives) and AutoCad 2012 / Revit CAD files on disk (CD Rom).

C. As-Built drawings should indicate the following information as a minimum:
   1. Indicate all addendum changes to documents.
   2. Remove Engineer’s seal, name, address and logo from drawings.
   3. Mark documents RECORD DRAWINGS.
   4. Clearly indicate: DOCUMENT PRODUCED BY
   5. Indicate all changes to construction during construction. Indicate actual routing of all piping, ductwork, etc. that were deviated from construction drawings.
   6. Indicate exact location of all underground plumbing and flow line elevation.
   7. Indicate exact location of all underground plumbing piping and elevation.
   8. Indicate exact location of all underground electrical raceways and elevations.
   9. Correct schedules to reflect (actual) equipment furnished and manufacturer.
   10. During the execution of work, maintain a complete set of drawings and specifications upon which all locations of equipment, ductwork, piping, devices, and all deviations and changes from the construction documents in the work shall be recorded.
   11. Location and size of all ductwork and mechanical piping above ceiling including exact location of isolation of domestic and plumbing valves.
   12. Exact location of all electrical equipment in and outside of the building.
   13. Fire Protection System documents revised to indicate exact location of all sprinkler heads and zone valves.
   14. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
   15. Cloud all changes.

1.7 SPACE REQUIREMENTS

A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.8 RELATION WITH OTHER TRADES

A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements.

B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.

C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them.

D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.

E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under that Division. Determine from the Contractor for the various trades, the Owner, and by direction from the Architect/Engineer, the exact location of all items.

1.9 CONCEALED AND EXPOSED WORK

A. When the word "concealed" is used in connection with insulating, painting, piping, ducts and the like, the work is understood to mean hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is understood to mean open to view.

1.10 GUARANTEE

A. Guarantee work for 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 22 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer will be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before bid due date. Submit

complete design and performance data to the Engineer.

1.14 OPERATING TESTS

A. After all plumbing systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect/Engineer. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.15 WARRANTIES

A. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.16 BUILDING CONSTRUCTION

A. It shall be the responsibility of each sub-contractor to consult the Architectural and Engineering drawings, details, and specifications and thoroughly familiarize himself with the project and all job related requirements. Each sub-contractor shall cooperate with the General Contractor to verify that all piping and other items are placed in the walls, furred spaces, chases, etc., so there will be no delays in the job.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 OPENINGS

A. Framed, cast or masonry openings for ductwork, equipment or piping are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.2 HOUSEKEEPING PADS

A. Provide equipment housekeeping pads under all floor mounted and ground mounted plumbing equipment, and as shown on the drawings.

B. Concrete work as specified in Division 3.

C. Concrete pads:
   1. 4" high, rounded edges, minimum 2500 psi unless otherwise indicated on the drawings
   2. Chamfer strips at edges and corner of forms.
   3. Smooth steel trowel finish.
   4. Doweled to existing slab

D. Install concrete curbs around multiple pipe penetrations.

3.3 VANDAL RESISTANT DEVICES

A. Provide a handle for each loose keyed operated valve and hose bibb on the project.

B. Do not use vandal resistant screws or bolts on the project.

C. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.4 INSTRUCTION OF OWNER'S PERSONNEL

A. Prior to final inspection, conduct an on-site training program to instruct the Owner's operating personnel in the operation and maintenance of the plumbing systems.
   1. Provide the training during the Owner's regular working day.
   2. The Instructors shall each be experienced in their phase of operation and maintenance of building plumbing systems and with the project.

B. Time to be allocated for instructions.
   1. Minimum of 8 hours dedicated instructor time.
   2. 4 hours on each of 2 days.

C. Before proceeding with the on-site training program, submit the program syllabus; proposed time and dates; and other pertinent information for review and approval.
   1. One copy to the Owner.
   2. One copy to the Architect/Engineer.

D. The Owner will provide a list of personnel to receive instructions, and will coordinate their attendance at the agreed upon times.

E. Use the operation and maintenance manuals as the basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.

F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shut down of each item of equipment.

G. Demonstrate equipment functions (both individually and as part of the total integrated system).

H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.

I. Submit a report within one week after completion of the training program that instructions have been satisfactorily completed. Give time and date of each demonstration and hours devoted to the demonstration, with a list of people present.

J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he/she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.

K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

3.5 EQUIPMENT IDENTIFICATION

A. Provide a laminated engraved plastic nameplate on each piece of equipment and starter.
   1. Designation approved by Architect/Engineer.

2. Equipment includes, but is not limited to, water heaters, pumps, boilers and utility controllers.
3. Submit schedule of equipment to be included and designations.

B. Provide nameplates with 1/2" high letters and fastened with epoxy or screws.

3.6 OBSTRUCTIONS

A. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
   1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
   2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.

B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.7 PROTECTION

A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

END OF SECTION

SECTION 22 05 10

PLUMBING CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Contract quality control including workmanship, manufacturer's instructions and demonstrations.

1.2 QUALITY CONTROL PROGRAM

A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents.

1.3 WORKMANSHIP

A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.

B. Perform work by persons qualified to produce workmanship of specified quality.

C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.

D. Provide finishes to match approved samples. All exposed finishes shall be approved by the Architect. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

A. Comply with instructions in full detail, including each step in sequence.

B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

A. When required in individual Specification Sections, manufacturer shall provide qualified personnel to observe:
   1. Field conditions.
   2. Condition of installation.
   3. Quality of workmanship.
   4. Start-up of equipment.
   5. Testing, adjusting, and balancing of equipment.

B. Representative shall make written report of observations and recommendations to Architect / Engineer.

PART 2 - PRODUCTS

2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS.

PART 3 - EXECUTION

3.1 PROTECTION OF EQUIPMENT

A. Do not deliver equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the Contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.

B. Adequately protect equipment from damage after delivery to the project. Cover with heavy tarpaulins, drop cloths or other protective coverings as required to protect from plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion.

END OF SECTION

SECTION 22 05 12

PLUMBING SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Prepare submittals as required by Division 1.

B. The term submittal, as used herein, refers to all:
   1. Shop Drawings
   2. Coordination Drawings
   3. Product data

C. Submittals shall be prepared and produced for:
   1. Distribution as specified
   2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.

B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.

C. Identify field dimensions; show relationship to adjacent features, critical features, work, or products.

D. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

1.3 COORDINATION DRAWINGS

A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: ¼” = 1’-0”.

B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation, and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.

C. For each mechanical room and for each outside equipment pad where equipment is located, submit plan and elevation drawings. Show:
   1. Actual mechanical equipment and components to be furnished
   2. Service clearance
   3. Relationship to other equipment and components
   4. Roof drains and leader piping
   5. Fire protection piping and equipment

D. Identify field dimensions. Show relation to adjacent or critical features of work or products.

E. Related requirements:
   1. Ductwork shop drawings
   2. Coordination drawing specified in Division 26

F. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

G. Gas piping sketch indicating proposed location of piping prior to proceeding with the installation.

1.4 PRODUCT DATA AND INSTALLATION INSTRUCTION

A. Submit only pages which are pertinent to the project. All options which are indicated on the product data shall become part of the contract and shall be required whether specified are not.

B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.

C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.

D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.

E. Mark up a copy of the specifications for the product. Indicate in the margin of each paragraph the following: “Comply, ”Do Not Comply”, or “Not Applicable”. Explain all “Do Not Comply” statements.

F. Provide a separate transmittal for each submittal item. Transmittals shall indicate product by specification section name and number. Separate all submittals into appropriate specification section number. Do not combine specification sections.

1.5 MANUFACTURERS INSTRUCTIONS

A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up, adjusting, calibrating, balancing and finishing.

1.6 CONTRACTOR RESPONSIBILITIES

A. Review submittals prior to transmittal.

B. Determine and verify:
   1. Field measurements
   2. Field construction criteria
   3. Manufacturer's catalog numbers
   4. Conformance with requirements of Contract Documents

C. Coordinate submittals with requirements of the work and of the Contract Documents.

D. Notify the Architect/Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.

E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect/Engineer's acceptance.

F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect/Engineer reviews submittals or not.

G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect/Engineer reviews submittals or not, unless Architect/engineer gives written acceptance of the specific deviations on reviewed documents.

H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
   1. Proper sizes and capacities
   2. That the item will fit in the available space in a manner that will allow proper service
   3. Construction methods, materials and finishes

I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

1.7 SUBMISSION REQUIREMENTS

A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.

B. Number of submittals required:
   1. Shop Drawings and Coordination Drawings: Submit one reproducible transparency and three opaque reproductions.
   2. Product Data: Submit the number of copies which the contractor requires, plus those which will be retained by the Architect/Engineer.

C. Accompany submittals with transmittal letter, in duplicate, containing:
   1. Date
   2. Project title and number
   3. Contractor's name and address
   4. The number of each Shop Drawing, Project Datum and Sample submitted
   5. Other pertinent data

D. Submittals shall include:
   1. The date of submission
   2. The project title and number
   3. Contract Identification
   4. The names of:
      a. Contractor
      b. Subcontractor
      c. Supplier
      d. Manufacturer
   5. Identification of the product
   6. Field dimensions, clearly identified as such
   7. Relation to adjacent or critical features of the work or materials
   8. Applicable standards, such as ASTM or federal specifications numbers
   9. Identification of deviations from contract documents
   10. Suitable blank space for General Contractor and Architect/Engineer stamps

11. Contractor's signed and dated Stamp of Approval

E. Coordinate submittals into logical groupings to facilitate interrelation of the several items:
   1. Finishes which involve Architect/Engineer selection of colors, textures or patterns
   2. Associated items which require correlation for efficient function or for installation

1.8 SUBMITTAL SPECIFICATION INFORMATION

A. Every submittal document shall bear the following information as used in the project manual:
   1. The related specification section number
   2. The exact specification section title

B. Submittals delivered to the Architect/Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.9 RESUBMISSION REQUIREMENTS

A. Make re-submittals under procedures specified for initial submittals.
   1. Indicate that the document or sample is a re-submittal
   2. Identify changes made since previous submittals

B. Indicate any changes which have been made, other than those requested by the Architect / Engineer.

1.10 CONTRACTOR'S STAMP OF APPROVAL

A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.

B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect/Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.

C. Do not deliver any submittals to the Architect/Engineer that do not bear the Contractor's stamp of approval and signature.

D. Submittals delivered to the Architect/Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.11 ARCHITECT/ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

A. The Architect/Engineer will:
   1. Review identified submittals with reasonable promptness and in accordance with schedule
   2. Affix stamp and initials or signature, and indicate requirements for re-submittal or approval of submittal
   3. Return submittals to Contractor for distribution or for resubmission

B. Review and approval of submittals will not extend to design data reflected in submittals which is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.

C. Architect/Engineer's review and approval is only for conformance with the design concept of the project and for compliance with the information given in the contract.
   1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
   2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.

D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

1.12 SUBSTITUTIONS

A. Do not make requests for substitution employing the procedures of this Section.

B. The procedure for making a formal request for substitution is specified in Div. 1.

PART 2 - PRODUCTS - NOT USED.

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 22 05 13

ELECTRICAL PROVISIONS OF PLUMBING WORK

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Electrical provisions to be provided as plumbing work are indicated in other Division 22 sections, on drawings, and as specified.

B. Types of work, normally recognized as electrical but provided as plumbing, specified or partially specified in this Section, include but are not necessarily limited to the following:
   1. Motors for plumbing equipment.
   2. Starters for motors of plumbing equipment, but only where specifically indicated to be furnished integrally with equipment.
   3. Wiring from motors to disconnect switches or junction boxes for motors of plumbing equipment, but only where specifically indicated to be furnished integrally with equipment.
   4. Wiring of field-mounted float control switches, flow control switches, and similar plumbing-electrical devices provided for plumbing systems, to equipment control panels.
   5. Pipe heat tracing.

C. Refer to Division 22 sections for specific individual plumbing equipment electrical requirements.

D. Refer to Division 26 sections for motor starters and controls not furnished integrally with plumbing equipment.

E. Refer to Division 26 sections for junction boxes and disconnect switches required for motors and other electrical units of plumbing equipment.

1.2 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to work of this Section.

1.3 QUALITY ASSURANCE

A. Wherever possible, match elements of electrical provisions of plumbing work with similar elements of electrical work specified in Division 26 sections for electrical work not otherwise specified.

B. For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards for definitions of terminology. Comply with National Electrical Code (NFPA 70) for workmanship and installation requirements.

1.4 SUBMITTALS

A. Include in listing of motors, voltage, notation of whether motor starter is furnished or installed integrally with motor or equipment containing motors.

PART 2 - PRODUCTS

2.1 MOTORS

A. Provide motors for plumbing equipment manufactured by one of the following:
   1. Baldor Electric Company.
   2. Century Electric Div., Inc.
   3. General Electric Co.
   4. Louis Allis Div.; Litton Industrial Products, Inc.
   5. Lincoln Electric
   6. Marathon Electric Mfg. Corp.
   7. Reliance Electric Co.
   8. Westinghouse Electric Corp.

B. Motor Characteristics. Except where more stringent requirements are indicated, and except where required items of plumbing equipment cannot be obtained with fully complying motors, comply with the following requirements for motors of plumbing work:

C. Temperature Rating. Rated for 40°C environment with maximum 50°C temperature rise for continuous duty at full load (Class A Insulation).

D. Provide each motor capable of making starts as frequently as indicated by automatic control system, and not less than 5 starts per hour for manually controlled motors.

E. Phases and Current Characteristics. Provide squirrel-cage induction polyphase motors for 3/4hp and larger, and provide capacitor-start single-phase motors for 1/2hp and smaller, except 1/6hp and smaller may, at equipment manufacturer's option, be split-phase type. Coordinate current characteristics with power specified in Division 26 sections, and with individual equipment requirements specified in other Division 22 requirements. For 2-speed motors provide 2 separate windings on polyphase motors. Do not purchase motors until power characteristics available at locations of motors have been confirmed, and until rotation directions have been confirmed.

F. Service Factor. 1.15 for polyphase motors and 1.35 for single-phase motors.

G. Motor Construction. Provide general purpose, continuous duty motors, Design "B" except "C" where required for high starting torque.
   1. Frames. NEMA #56.
   2. Bearings are to be ball or roller bearings with inner and outer shaft seals, regreasable except permanently sealed where motor is inaccessible for regular maintenance. Where belt drives and other drives produce lateral or axial thrust in motor, provide bearings designed to resist thrust loading. Refer to individual section of Division 22 for fractional-hp light-duty motors where sleeve-type bearings are permitted.
   3. Except as indicated, provide open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation, and provide guarded drip-proof motors where exposed to contact by employees or building occupants. Provide weather-protected Type I for outdoor use, Type II where not housed. Refer to individual sections of Division 22 for other enclosure requirements.
   4. Provide built-in thermal overload protection and, where indicated, provide internal sensing device suitable for signaling and stopping motor at starter.
   5. Noise Rating: Provide "Quiet" rating on motors.

H. All motors shall be premium efficiency.

2.2 EQUIPMENT FABRICATION

A. Fabricate plumbing equipment for secure mounting of motors and other electrical items included in work. Provide either permanent alignment of motors with equipment, or adjustable mountings as applicable for belt drives, gear drives, special couplings and similar indirect coupling of equipment. Provide safe, secure, durable, and removable guards for motor drives. Arrange for lubrication and similar running-maintenance without removal of guards.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motors on motor mounting systems in accordance with motor manufacturer's instructions, anchored to resist torque, drive thrusts, and other external forces inherent in plumbing work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.

B. Verify voltage with Electrical Plans.

END OF SECTION

SECTION 22 05 14

PLUMBING ALTERATIONS PROJECT PROCEDURES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Inspect and service existing equipment and materials that are to remain or to be reused.

B. Disposal of equipment, materials, or housekeeping pads to be abandoned. Prior to disposal, the Contractor shall verify with the Owner what is to be salvaged by the Owner and what is to become the property of the Contractor.

C. Handling of equipment and materials to be removed.

1.2 QUALITY ASSURANCE

A. Coordination with the Owner prior to the disconnection or shutdown of existing equipment, or to the modification of existing operational systems.

1.3 CONTRACT DRAWINGS

A. There is the possibility that existing conditions and devices are affected by the work indicated on the drawings and called for in the specifications (project manual) that do not appear on the drawings. It is the Contractor's responsibility to visit the site and determine all of the existing conditions and to consider these existing conditions when making and presenting a proposal, to have a complete proposal.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Material used to upgrade and repair existing equipment shall conform to that specified.

B. Material used to upgrade and repair existing equipment shall not void existing warranties or listings of the equipment to be upgraded or repaired.

C. Material used to upgrade and repair existing equipment shall be new and shall be of the same manufacturer of the existing equipment, shall be acquired through the existing original equipment manufacturer's approved distribution channels, shall have manufacturer's warranties for the new material being used, and shall be listed for the use intended.

PART 3 - EXECUTION

3.1 INSPECTION

A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be inspected for damaged or missing parts. Contractor shall notify the Architect/Engineer, in writing, accordingly.

B. If using materials specified or shown on the drawing voids or diminishes the warranty or operation of remaining equipment or systems, the Contractor shall notify the Architect/Engineer, in writing.

C. Verify field measurements, above and underground piping connections and flows.

D. Demolition Drawings are based on casual field observation, and when available, existing record documents. Report discrepancies to Architect before disturbing existing installation, and immediately after such discrepancies are discovered.

E. Field verify existing conditions and actual utility uses prior to final connections. Existing drawings may not have been available for all required information. Use pipe inspection camera system to field verify existing sanitary / grease waste connections. Verify flow direction and depth prior to connection to existing plumbing systems.

3.2 APPLICATION

A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be cleaned and reconditioned, including cleaning of piping systems prior to installation and reuse.

B. Material and equipment removed that is not to be salvaged for Owner's use or for reuse on the project shall become the property of the Contractor and be removed from the site.

C. Material or equipment salvaged for Owner's use shall be carefully handled and stored where directed by the Owner or the Architect / Engineer. Relocate material and / or equipment as directed by Owner.

D. Materials and equipment not indicated to be removed or abandoned shall be reconnected to the new system.

E. Materials, equipment and housekeeping pads not to be reused or reconnected shall be removed for Owner’s review and salvaged by Contractor.

F. Prior to start of construction, Contractor shall walk areas to be renovated with Owner to identify and document items to be salvaged for Owner’s use.

G. Clean and repair existing materials and equipment that remain or are to be reused.

H. Contractor shall utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

3.3 SEQUENCE AND SCHEDULE

A. Coordinate utility service outages with Utility Company, Architect and Owner.

B. Provide additional or temporary valves, piping and connections to maintain existing systems in service during construction.

C. Existing Plumbing Service: Refer to drawings for work in remodeled areas. Where facilities in these areas are to remain in service, any related work to keep the facilities in operation is specified in this Division. Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 48 hours before partially or

completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Maintain acceptable temperature and humidity control within existing building during renovation activities.

D. Remove and replace existing Plumbing systems and appurtenances as occasioned by new or remodeled construction. Re-establish service that may be interrupted by remodeled construction.

E. Refer to other drawings series for work in remodeled areas. Where facilities in these areas are required to remain in service, any related work required to keep these facilities in operation is specified in this Division.

F. Remove and replace existing piping coincident with the construction.

G. Remove or relocate existing piping or housekeeping pads as occasioned by new or remodeled construction. Cap unused domestic piping beyond the new finish line.

H. Relocate all domestic piping as required to accommodate new work requiring precedence.

I. Remove concrete housekeeping pad where materials or equipment have been removed.

J. Remove all known utilities that do not provide service to the buildings that remain.

K. Remove existing plumbing vent penetrations through roof not to be reused. During demolition, abandoned plumbing vents are to be removed in their entirety. Do not cap the vent pipes below the roof deck and abandon in place. The hole in the roof is to be patched and made water tight.

3.4 DEMOLITION AND EXTENSION OF EXISTING PLUMBING WORK

A. The Contractor shall modify, remove, and/or relocate all materials and items so indicated on the drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain the property of the Owner, and shall be delivered to such destination as directed by the Owner’s representative unless they are not wanted, then it will be the responsibility of this Contractor to remove such items and properly dispose of them. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition. The Contractor may, at his discretion, and upon approval of the Owner’s representative substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.

B. All items to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean, repair, and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore them to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.

C. When items scheduled for relocation and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner’s representative to such items and receive further instructions before removal. Items damaged in repositioning operations are the contractor’s

responsibility and shall be repaired or replaced by the contractor as approved by the owner's representative, at no additional cost to the Owner.

D. Plumbing, piping and appurtenances to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner's representative. Piping not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied-off or disconnected in a safe manner acceptable to the Construction Inspector. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities that must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner's representative hereinbefore specified.

E. Repair adjacent construction and finishes damaged during demolition and extension work.

F. Maintain access to mechanical installations that remain active. Modify installation or provide access panel as appropriate.

G. Extend existing installations using materials and methods compatible with existing plumbing installations, or as specified.

H. Existing plumbing piping and devices found to need additional hangers installed should be added at no additional cost to the Owner.

3.5 PROTECTION OF THE WORK

A. Provide adequate temporary support and auxiliary structure as necessary to ensure structural value or integrity of affected portion of work.

B. Provide devices and methods to protect other portions of work from damage.

C. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

3.6 IDENTIFICATION OF EQUIPMENT IN RENOVATED AREAS

A. Identification of Equipment: Provide new identification of all existing equipment to be reused and located within the renovated areas. Do not include the description "existing". Provide new nameplates for all existing plumbing equipment in renovated areas as specified in Section 22 05 00 Plumbing General Provisions.

END OF SECTION

SECTION 22 05 15

PLUMBING EARTHWORK

PART 1 - GENERAL

A. Excavate and backfill for pipe trenches for underground piping, and excavate for structures installed as part of plumbing work.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavate trenches for underground piping to the required depth to ensure 2 foot minimum coverage over piping.

B. Cut the bottom of the trench or excavation to uniform grade.

C. Should rock be encountered, excavate 6 inches below grade, fill with bedding material and tamp well.

D. Lay out alignment of pipe trenches to avoid obstructions. Assure that proposed route of pipe will not interfere with building foundation before any cutting is begun. Should interference be found, contact the Architect/Engineer before proceeding.

3.2 BACKFILL

A. Backfill shall not be placed until the work has been inspected, tested and approved. Complete backfill to the surface of natural ground or to the lines and grades shown on drawings. Except where special materials are requested, use suitable friable soils from other excavation as backfill material. Do not use peat, silt, muck, debris or other organic materials. Deposit backfill in uniform layers and compact each layer as specified in Division 2.

B. Compacting Backfill. Place material in uniform layers of prescribed maximum thickness and wet or dry the material to optimum moisture content. Compact with power-driven tampers to the prescribed density. Place regular backfill in 8 inch maximum layers, loose measure. Compact to not less than 95% of maximum soil density as determined by ASTM D-698 Standard Proctor.

C. Restoration. Compact backfill, where trenching or excavation is required in improved areas such as pavements, walks, and similar areas, to a condition equal to the adjacent undisturbed earth, and restore surface of the area to the condition existing prior to trenching or excavating operation.

3.3 DISPOSAL OF EXCESS MATERIAL

A. Remove excess excavation material or material unsuitable for backfill. Excess material can be spread on grade, or shall be removed from site as directed by the Owner / Architect.

END OF SECTION

SECTION 22 05 16

EXCAVATING, BACKFILLING AND COMPACTING FOR UTILITIES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 apply to this section.

B. Refer to Instructions to Bidders for substitution of materials and products.

C. Addenda issued during the bidding period that affect this section of the specifications.

1.2 WORK INCLUDED

A. Coordinating all excavating and backfilling for the underground storm sewer, sanitary sewer, water distribution lines, and all related appurtenances.

B. The extent of lines, excavation, and backfill shall be in conformance with the locations, lines, elevations and grades shown on the drawings prepared by the MEP Engineer.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Earthwork

B. Water Distribution

C. Sanitary Sewer

D. Plumbing

1.4 REFERENCES

A. American Society for Testing and Materials (ASTM) Use current edition.
   1. ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3)
   2. ASTM D1556, Standard Test method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
   3. ASTM D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
   4. ASTM D4254, Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density

B. City Standards

C. Local Governing Agencies

D. Texas Health and Safety Code, Chapter 161, Subchapter Q, as amended by House Bill No. 1927.

1.5 WARRANTY

A. Provide written warranty against defects in the material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion of the Project. Refer to Division 1 for Warranty form.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Sand: Clean, local sand

B. Earth Backfill: Clean local material consistent with the surrounding earth material and free of large clods, roots, rocks or other debris.

PART 3 – EXECUTION

3.1 EXCAVATION

A. General:
1. All utility trenches shall be constructed in conformance with OSHA trench safety standards.
2. Sheeting and shoring shall be accomplished to the extent necessary to maintain the sides of the trench in a vertical position throughout the construction period for trenches five feet in depth or deeper. Where approved, trench sides may be laid back in lieu of shoring to meet OSHA safety standards.
3. Utilities shall not be constructed or laid in a trench in the presence of water. All water shall be sufficiently removed from the trench prior to the line placing operation to ensure a dry, firm bed on which to place the utility line.

B. Storm and Sanitary Sewer Trenches:
1. For pipe sizes less than 42 inches in diameter, the minimum trench width shall be outside diameter of pipe plus 18 inches.
2. Trenches shall be excavated to a depth of at least 6 inches below the barrel of pipe.

C. Appurtenances:
1. Any overdepth excavation below appurtenances shall be refilled with compacted select fill or bank sand.

D. Water Line Trenches:
1. Water lines shall be at least two feet in depth from the top of proposed grade to the top of pipe.
2. Trench width for water lines shall be a minimum of the outside pipe diameter plus 18 inches.
3. Trenches shall be excavated to a depth of at least 6 inches below the barrel of pipe.

3.2 PIPE BEDDING AND BACKFILL – BELOW BUILDING SLAB

A. Storm and Sanitary Sewer Trenches:
1. Bedding, sewer pipe, and initial backfill over the pipe must be placed in a single day for any given portion of pipe. Initial backfill consisting of bank sand or select backfill shall be placed to one foot above the top of pipe for standard earth backfill.
2. Remainder of trench backfill shall be placed the next day or later in 8 inch lifts.

3. Backfill shall be placed in uniform layers not to exceed 8 inches loose measured depth, and compacted to a minimum of 95% of Standard Maximum Density (ASTM D698).

B. Water Line Trenches Below Building Slab/Outside Building Slab:
1. Pipe bedding shall consist of 6 inches of clean sand placed before the pipe is laid.
2. After laying pipe and ensuring that the pipe is properly placed and supported by the sand bedding, clean sand backfill shall be placed to 6 inches above the top of pipe. The sand backfill shall be thoroughly rodded and tamped for compaction.
3. For water lines to be beneath the building and pavement and to one foot from the outer edge of pavement, the remainder of the trench backfill shall be clean sand placed in 6 inch lifts and compacted to 95% Standard Proctor.
4. For water lines not beneath the building and pavement or within one foot from the outer edge of pavement the remainder of the trench backfill shall be earth fill placed in uniform layers not to exceed 8” loose depth. Each lift shall be compacted to a minimum of 90% of Standard Density (ASTM D698) at the proper moisture content specified in the soils report for this project. All earth backfill shall be placed the next day or later after the pipe is laid.
5. Backfill, under pavement and to one foot from outer edge, up to one foot below subgrade elevation. Remainder of backfill to subgrade to be as specified in paragraph 4 above.

3.3 PIPE BEDDING AND BACKFILL – OUTSIDE BUILDING SLAB

A. Storm and Sanitary Sewer Trenches:
1. Bedding, sewer pipe, and initial backfill over the pipe must be placed in a single day for any given portion of pipe. Initial backfill consisting of bank sand or select backfill shall be placed to one foot above the top of pipe for standard earth backfill.
2. Remainder of trench backfill shall be placed the next day or later in 8 inch lifts.
3. Backfill shall be placed in uniform layers not to exceed 8 inches loose measured depth, and compacted to a minimum of 95% of Standard Maximum Density (ASTM D698).
4. Backfill, under pavement and to one foot from outer edge, up to one foot below subgrade elevation. Remainder of backfill to subgrade to be as specified in paragraph 3 above.

3.4 NATURAL GAS PIPING

A. Natural Gas Trenches:
1. Natural gas lines shall not be installed under slabs on grade unless pipes are sleeved and vented as per Section 22 63 11.
2. Natural gas lines shall not be installed in trenches with other utilities.

B. Utility Locators:
1. Provide metallic locator over all non-metallic gas piping utilities. Locator tape shall be a maximum of 12 inches below grade and centered over the utility(s).

END OF SECTION

SECTION 22 05 17

PLUMBING ACCESS DOORS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install access doors in wall or ceiling locations as required or shown for access to valves, controls, regulating devices, water arresters and other equipment requiring maintenance, adjustment or operation.

PART 2 - PRODUCTS

2.1 NON-FIRE RATED ACCESS DOORS

A. 16-Gauge frames

B. 14-gauge steel panels

C. Continuous fully concealed hinges

D. Flush screwdriver cam lock for Owner selection

E. Prime coat finish

F. Brushed satin stainless steel finish for restroom, kitchen or cafeteria installation

G. Material suitable for wall and/or ceiling mounting

2.2 FIRE RATED ACCESS DOORS

A. UL listed, 1-1/2 hour Label “B”, access doors

B. 16-Gauge stainless steel

C. 20-Gauge insulated sandwich-type door panel.

D. Two inch thick with fire rated insulation

E. Continuous fully concealed hinge

F. Automatic closing and latching mechanism

G. Knurled knob and recessed key operation for Owner selection

H. Interior latch release slide for opening from inside

I. Prime coat finish

J. Material suitable for wall and/or ceiling mounting

2.3 ACCEPTABLE MANUFACTURERS

A. Milcor

B. MIFAB

C. Acudor

D. Elmdor

PART 3 - EXECUTION

3.1 INSTALLATION

A. Access doors specified in Division 22 will be installed by other crafts. Not all required access doors are shown. Coordinate with the Contractor to locate access doors for ease of operation and maintenance of concealed equipment.

B. Installation shall be in accordance with the manufacturer's printed instructions.

C. Minimum size required:
   1. 24" x 24" for plumbing multiple isolation valves and electrical related items in ceilings
   2. 8"x8" for plumbing for single isolation valve or shock arrestor

END OF SECTION

SECTION 22 05 19

PRESSURE AND TEMPERATURE INSTRUMENTS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. This section specifies gauges, thermometers, wells and/or pressure and temperature test stations to be installed as specified.

1.2 RELATED WORK

A. Division 22, Plumbing
   1. Plumbing General Provisions
   2. Pipe and Pipe Fittings, General
   3. Valves, Strainers and Vents

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - GAUGES AND THERMOMETERS

A. Trerice

B. Taylor

C. Marsh

D. Weksler

E. Marshalltown

F. Weiss

G. Miljoco

2.2 PRESSURE GAUGES

A. Case and Ring: 4" 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: Domestic Water 4CTSLF (Lead Free) 0-100 PSI

2.3 THERMOMETER WELLS

A. Brass or type 300 stainless steel. Machined bar stock, 1-piece construction (Lead Free).

B. Where installed in insulated piping or vessels, provide with extension neck to match insulation thickness.

C. Provide metal-to-metal contact with bulb chamber for maximum sensitivity.

D. Wells shall be sized to extend a minimum of 50% 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 (Lead Free).

H Accuracy: +/- 1% of scale range.

I. Range:
1. Hot water lines: 30°F to 240°F.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with drawing details and manufacturer's recommendations.

B. Provide a ball valve at each gauge (Lead Free).

C. Locate gauges and thermometers to be easily readable from the floor at a 5'-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, storage tanks, heat exchangers.

E. Install thermometer in the following locations: At storage tanks, across heat exchangers, across boiler, leaving side of water heater, leaving water side of tempered water valves, and hot water supply and return lines.
1. Hot water lines: 30°F to 240°F.
2. Tempered water valves 0°F to 120°F.

END OF SECTION

SECTION 22 05 23

VALVES, STRAINERS AND VENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Plumbing Valves

B. Pipe strainer and suction diffusers.

PART 2 - PRODUCTS

2.1 VALVES

A. Pressure Ratings:
   1. Unless otherwise indicated, use valves suitable for 125 minimum psig working steam pressure (WSP) and 450°F.
   2. The pressure temperature rating of valves shall be not less than the design criteria applicable to components of the system.
   3. Use grooved butterfly valves when using grooved piping.

B. Butterfly Valves
   1. Butterfly valves shall conform to MSS-SP67.
   2. 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.
   3. All valves for domestic use must be lead free.
   4. Do not use Victaulic flanges on butterfly valves.
   5. All butterfly valves shall have a stainless steel disc.

C. Thermal Balancing Valves (Fixed Temperature)
   1. Static balancing valve with integral flow meter and site gauge, combined with built in temperature gauge and check valve. Designed for balancing domestic hot water circulation systems.
   2. Standards: NSF/ANSI/CAN 372 low-lead laws, as certified by ICC-ES.
   3. Maximum Working Pressure: 150 psig.
   4. Working Temperature Range: 14 to 230 deg. F.
   5. Valve Body, Flow Meter Body and Headwork: DZR low-lead brass.
   6. Ball and Flow Meter Springs and Bypass Valve Stem: Stainless steel.
   7. Ball Control Stem: Brass, chrome plated.
   8. Ball Seal Seat: PTFE
   9. Control Stem Guide, Flow Meter Float, and Indicator Cover: Polysulfone
   10. Built-In Direct Reading Flow Meter:
      a. Detachable bypass channel for cleaning or replacement.
      b. Memory sliding pointer providing flow rae memory indication.
   11. Seals: Peroxide-cured EPDM
   12. Ball/Magnet Flow Indicator: Sealed, isolated chamber, not in contact with system fluid to provide clear, accurate readings.
   13. Outlet Temperature Gauge: 30 to 210 deg. F., 2-inch diameter dual-scale temperature gauge.
   14. Insulation shell
   15. Isolation Ball Valves: Inlet and outlet low-lead brass
   16. Manufacturers:

a. Caleffi
b. Therm Omega Tech (Circuit Solver)
c. Viega

D. Ball Valves
1. Provide ball valves with:
a. Blowout proof stem.
b. Full size port, 316 stainless steel ball and stem.
c. Cast bronze body.
d. Threaded ends.
2. Seat, seals, thrust washers and packing shall be suitable for the intended service.
3. Service rating:
a. 150 psi saturated steam.
b. 600 psi WOG.
4. Provide with memory stop for balancing valves.
5. Where Viega ProPress fittings are used, Viega ProPress ball valves may be used, or as approved.
6. All valves for domestic use must be lead free.
7. Do not use PVC or CPVC ball 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.
6. Use press valves when using copper press systems.

F. Valve Operators
1. Provide suitable hand-wheels for gate, globe, angle or drain valves and inside hose bibbs.
2. When cocks and valves are furnished with square head stem:
a. Provide one wrench for every ten cocks or valves sized 2" and smaller, minimum of two.
b. Provide each cock or valve size 2-1/2" and larger with a wrench with setscrew.
3. 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. All butterfly valves shall have a stainless steel disc.

G Acceptable Manufacturers (All listed must be lead free);
1. Stockham
2. Dezurik
3. Crane
4. Nibco
5. Keystone

6. Jenkins
7. Kitz
8. Apollo
9. Milwaukee Valve

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 (All listed must be lead free):
   a. Mission Duochek
   b. Nibco
   c. Keystone
   d. Kitz
   e. Apollo

I. Backflow Preventer (All valves for domestic use must be lead free):
1. BFP-1 (2” and smaller) bronze body, reduced pressure zone type with two inline independent check valves with an intermediate relief valve, complete with two full port ball valve shut-offs and ball type test cocks. Bronze strainer on inlet. Provide air gap fitting with full size drain piped to nearest floor drain. Watts 909-QT-S-LF.
2. BFP-2 (2-1/2” and larger) stainless steel reduced pressure zone type with two inline independent check valves with reverse relief valves, two non-rising stem resilient sealed gate valves, cast iron strainer on inlet. Provide air gap fitting piped full size to nearest floor drain. Apollo RP4ALF-YS.

J. Provide valves of same manufacturer throughout where possible.

K. Provide valves with manufacturer's name and manufacturing location, duty and pressure rating clearly marked on outside of body.

L. Where valves are installed in insulated piping, provide with extended neck so valve operator and stop plate clears the full thickness insulation.

M. Provide valve, seat and trim materials suitable for the intended service.

N. Provide memory stops for all valves used for throttling service. Valves for throttling service shall be butterfly, plug, globe or ball type.

2.2 PIPE SYSTEMS STRAINERS

A. Body:
1. Bronze "Y" pattern or basket as shown on the drawings.
2. Line size.
3. Threaded strainer blow down port.
4. ASTM A #126 Class B Cast Iron Body.

B. Construction:
1. 2" 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 Owner's review.

E. Acceptable Manufacturers (All listed must be lead free):
1. Apollo
2. Crane
3. Keckley
4. Kitz
5. McAlear
6. Mueller
7. Muesco
8. Nibco
9. Zurn

2.4 VALVE SCHEDULE

A. Domestic Service
1. Gas shut-off service: UL approved for natural gas service.
   a. Nibco Ball Valve, full port through 1": T-585-70-UL
   b. Nibco Ball Valve conventional port 1-1/4" through 3": T-580-70-UL
   c. DeZurick 2-1/2" and larger: Series 425 or 435
   d. Conbraco Ball Valve, full port through 4": 64-100 Series
   e. Milwaukee Full Port ¼"-2" #8303A
   f. Milwaukee Standard Port 2-1/2" & 3" #8503
   g. Kitz Full Port 2" =- #68
   h. Apollo
2. Cold and Hot water service (all listed must be Lead Free):
   a. Nibco Ball Valve full port through 2": T-585-66-LF
   b. Nibco Butterfly Valve 2-1/2" and larger: LD-2000 EDPM Gaskets
   c. Viega ProPress Bronze Ball Valves (where Viega ProPress fittings are used)
   d. Kitz Full Port through 2" - #868M Lead Free
   e. Milwaukee Full Port ¼"-2" #8303A
   f. Milwaukee Standard Port 2-1/2" & 3" #8503
   g. Apollo Full Port to 3-1/2" 77CALF
   h. Apollo Conventional Port 2-1/2"=3" 7OLF
3. Compressed air system
   a. Nibco Ball Valve full port through 2": T-585-70-66
   b. Nibco Ball Valve 2-1/2" and 3" conventional port: T-580-70-66
   c. Viega ProPress Bronze Ball Valves (where Viega ProPress fittings are used)
4. Check Valve (All listed must be Lead Free):
   a. Nibco Check Valve: T - 413 – Y -LF (Teflon Seats)
   b. Nibco Check Valve 2-1/2" and larger: F - 918 – Y -LF (Buna-N Disc)
   c. Nibco Check Valve 2-1/2" and larger: W - 920 -W-LF (Wafer)
   d. Kitz Y & Check: A-22T
   e. Kitz 2-1/2" and Larger #778 C.I.
   f. Kitz Wafer Check 2-1/2" and Larger #7032

g. Apollo Check Valve 163 TLF
h. Apollo Check Valve 2-1/2” – Larger 910 FLF

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install valves with stems upright or horizontal, not inverted.

B. Install valves for shut-off and isolating service at each piece of equipment, at vertical risers, and where shown on the drawings.

C. Use butterfly valves and ball valves in domestic hot water and domestic cold water systems interchangeable in place of gate and globe valves.

D. Use butterfly valves and ball valves in circulating water systems, for balancing duty.

E. Provide drain valves at main shut-off valves and low points of piping and apparatus so the systems can be entirely drained.
1. 1" 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.

F. Provide isolation valves in domestic water lines to isolate all equipment, restrooms, hose bibbs, and where shown on the drawings.

G. Where valves are installed in insulated pipe, valve operator shall have an insert so the lever or handle will not damage the insulation. Install handles so the lever or handles will not damage the insulation.

H. Provide clearance for installation of insulation and access to valves.

I. Provide access where valves are not exposed.

3.2 VALVE TAGS

A. Furnish valves with 1-1/2" diameter brass valve tags with stamped, black or red-filled numbers. Service designations shall be 1/4" letters, and valve numbers shall be 2" letters. Engineer shall approve Service designations. Secure tags to valves by use of brass "S" hooks or brass chain. Secure chain to valve by use of copper or Monel meter seals. Valve tags are not required if the valve is located within 3' of the equipment being served and the service is obvious.

B. Mount charts and drawings listing functions of each valve and its location in a metal and glass frame. Place charts and drawings as directed; in addition, on the record drawings mark the symbols and furnish a valve schedule properly identifying the valve number, service, exact location, the material being piped, and the room number of area that the valve services. This schedule shall be furnished on reproducible drafting paper or film suitable for reproduction on an Ozalid machine. The Owner shall approve the size of drafting paper. Provide a copy of the valve chart in the Operating and Maintenance Manuals.

3.3 PIPE SYSTEMS STRAINERS

A. Provide strainers in supply piping to circulating pumps, thermostatic mixing valves, before solenoid valves and trap primer valves.

END OF SECTION

SECTION 22 07 19

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install piping insulation, jackets, accessories and covering of specified materials. The insulation shall be used for high and low temperature piping applications including domestic hot and cold water, roof and overflow drain sump bodies and rain leaders, horizontal sanitary drain piping which receives condensate, make-up water and pool heating water.

1.2 QUALITY ASSURANCE

A. The intent of insulation specifications is to obtain superior quality workmanship resulting in an installation that is absolutely satisfactory in both function and appearance. Provide insulation in accordance with the specifications for each type of service and apply as recommended by the manufacturer and as specified.

B. An approved contractor for this work under this Division shall be:
   1. A specialist in this field and have the personnel, experience, training, skill, and the organization to provide a practical working system.
   2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that have served their owners satisfactorily for not less than 3 years.

C. All piping insulation used on the project inside the building must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50, as determined by test procedures ASTM E 84, NFPA 255 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements and bear the UL label.

D. Condensation on any insulated piping system is not acceptable.

E. Replace insulation damaged by either moisture or other means. Insulation that has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation. Also repair any damage caused by the condensation.

F. Where existing insulated piping, or other surfaces are tapped, remove existing insulation back to undamaged sections for hot surfaces or to nearest insulation stop for cold surfaces, and replace with new insulation of the same type and thickness as existing insulation. Apply as specified for insulation of the same service.

1.3 APPROVALS

A. Submit product data on each insulation type, adhesive, and finish to be used in the work. Make the submittal as specified in Division 1 General Requirements and obtain approval before beginning installation. Include product description, list of materials and thickness for each service and location and the manufacturer's installation instructions for each product.

B. Make a field application of each type of insulation to display the material, quality and application method. Obtain approval of the sample application before proceeding with installation of the work.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Glass fiber pipe insulation:
   1. Johns-Manville Micro-Lok AP-T
   2. Owens-Corning ASJ/SSL
   3. Knauf ASJ/SSL

B. Cellular Glass Insulation (Foamglass):
   1. Pittsburg Corning
   2. Cell-U-Foam

C. Aluminum Jacketing:
   1. Childers
   2. Pabco
   3. RPR

D. Fiberglass reinforcing cloth mesh:
   1. Perma Glass Mesh
   2. Alpha Glass Mesh
   3. Childers Chil-Glas
   4. Vimasco

E. Mastics and Adhesives
   1. Childers
   2. Foster
   3. Vimasco
   4. Armstrong 520 Adhesive

F. Elastomeric Insulation
   1. Armacell

G. Weather Resistant Coating
   1. WB Armaflex Finish

H. Glass fiber blanket insulation
   1. Manville R-series Microlite FSKL
   2. Owens-Corning eD75 or ED100 RKF
   3. Knauf 0.75 PCF FSK

2.2 FIBERGLASS PIPE INSULATION

A. Heavy density, dual temperature fiberglass insulation with factory applied, all service, reinforced vapor barrier jacket having integral laminated vapor barrier. Provide with a factory applied pressure sensitive tape closure system and matching butt strips. Supply in thickness as shown.
   1. Thermal conductivity 0.23 @ 75°F mean (ASTM 335).

2.3 ELASTOMERIC INSULATION

A. Insulation material shall be flexible, closed-cell elastomeric insulation in tubular or sheet form. Material shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E84, latest revision. Sheet material with a thickness greater than ¾" shall have a flame spread rating of 25 or less and a smoke developed rating of 100 or less when tested in accordance with ASTM E84, latest revision. In addition, the product, when tested, shall not melt or drip flaming particles, and the flame shall not be progressive. In addition, all materials shall pass simulated end-use fire test. Minimum ¾" thick.

1. Thermal conductivity 0.27 at 75°F mean (ASTM C177 or C518)

2.4 CELLULAR GLASS INSULATION

A. ASTM C552:

1. "k" value of 0.35 @ 75°F ("ksi" value of 0.047 @ 24°C);
2. 8.0 lb/cu.ft. (128 kg/cu.m.) density

2.5 INSULATION/SHIELD AT HANGERS

A. Field fabricated: Use 360° sections of rigid foamglass insulation that will support the bearing area at hangers and supports. Further support insulation at hangers and supports with a shield of galvanized metal covering at least half of the pipe circumference, and conforming to the schedule. Insulation shall extend at least 1" beyond metal shield on each end. When pipe is guided at top and bottom, metal shields shall cover the whole pipe circumference. Adhere metal shield to insulation so that metal will not slide with respect to insulation with ½" aluminum bands (2) per shield.

1. Sections of foam glass insulation may be used of the same outside diameter of the adjoining pipe insulation.
2. Minimum thickness of foam glass insulation shall not be less than 1" thick.

B. Pipe saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter or more than 22". Provide 18 gauge through 4" pipe and 16-gauge 5" pipe and above.

2.6 SEALANT, ADHESIVE AND FINISH

A. Lap Adhesive. Provide Childers CP-82 adhesive.

B. Vapor Barrier Finish:

1. Indoors: Provide as insulation coating Childers CP-35, white.
2. Outdoors: Provide as insulation coating Childers Encacel X.
3. Underground: Provide Childers CP-22/24 for fittings and areas. Pittwrap cannot be used.

C. Sealant. Provide Childers CP-76 vapor barrier sealant.

D. Lagging Adhesive. Provide Childers CP-50.

E. Other products of equal quality will be acceptable only upon approval.

2.7 ALUMINUM JACKETING

A. Finish insulated piping outdoors with a smooth prefabricated Z-lock aluminum jacket 0.016" thick with factory applied 1 mil polyethylene/40 lb and Fab strap. Kraft moisture barrier. Childers Lock-On or approved equal.

B. Valves, Fittings and Flanges. For finishing valves, fittings, flanges and similar installations, provide formed aluminum covers, 0.024” thick.

C. Straps and Seals. Provide ½” x 0.020 stainless steel strapping and seals for jackets and covers according to manufacturer's recommendations.

2.8 GLASS FIBER BLANKET INSULATION

A. Minimum density of 1.0 PCF, 2” thick, installed R value to be 6.0 or better at 75°F mean, facing of 0.35 mil foil reinforced with glass yarn mesh and laminated to 40 lbs fire resistant kraft.

PART 3 - EXECUTION

3.1 INTERIOR PIPING

A. Cover all piping with glass fiber, heavy density, dual temperature pipe insulation with a vapor barrier jacket. Apply insulation to clean, dry pipes. Longitudinal seams shall be joined firmly together and sealed with self-sealing lap joints. Butt insulation joints firmly together and seal with a 3” wide ASJ butt strip seal. Longitudinal seams and butt strip laps shall be coated and sealed with CP-35 vapor barrier coating for chilled water piping applications.

B. Install hanger with protective shield, on the outside of all insulation.

C. Where domestic water pipes (1/2” & ¾” pipe sizes) are installed on trapeze type hangers, provide galvanized sheet metal protection shields at these locations. Place insulation jacket directly on hanger. Incompressible, load bearing insulation segments are not required.

D. Pipe Saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter. Provide 18-gauge through 4” pipe and 16-gauge for 5” pipe and above.

E. Seal ends of pipe for drinking chilled water insulation with vapor barrier mastic at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the glass, down onto the pipe making a complete seal.

F. Apply a smooth flood coat of white lagging Foster 8142W over all exposed insulation.

G. Piping to be insulated as specified above:
   1. Domestic hot water and cold water (cold water piping is to be insulated in outside walls to 5’ inside building, and in any location subject to freezing). Maintain insulation for domestic hot and cold water in Mechanical Rooms and Central Plant.
   2. Make-up water
   3. Horizontal sanitary drain piping that receives condensate
   4. Exposed to view storm drainage system including roof and overflow drain bodies, vertical piping from drain body to elbow, all horizontal rain leaders, and first elbow turning down

3.2 PIPING OUTDOORS ABOVE GRADE

A. Insulate all water piping exterior of building above grade with rigid foam insulation and aluminum jacketing.

B. Adhere the vapor barrier jacket longitudinal seam with vapor barrier adhesive.

C. Cover all valves, fittings and flanges with factory made molded or field fabricated segments of pipe insulation of a thickness and material equal to the adjoining insulation. Adhere segments together with no voids, using CP-82 adhesive. Secure fitting insulation covers and segments in place with ½" wide glass filament tape.

D. Apply a tack coat of fitting mastic over the insulation and tape.

E. Neatly embed with 10 x 10 fiberglass cloth into the tack coat.

F. Apply mastic over the fiberglass cloth to a thickness where the fabric is not visible after completion.

G. Seal ends of pipe insulation with vapor barrier mastic at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the foam, down onto the pipe, making a complete seal.

H. Finish with aluminum jacketing as specified.

3.3 FLANGE, VALVE AND FITTING INSULATION

A. Cover valves and flanges with fabricated segments, fittings with two-piece factory molded fittings, and both of matching pipe insulation type and thickness equal to that of the adjoining pipe. Fittings and fabricated segments shall be securely held in place.
   1. Apply a tack coat of insulating mastic to the insulated fitting to produce a smooth surface.
   2. After mastic is dry, apply a second coat of vapor barrier mastic. Neatly embed with 10 x 10 fiberglass cloth into the tack coat.
   3. Overlap mastic and fiberglass cloth by 2" on adjoining sections of pipe insulation.
   4. Apply a second coat of mastic over the fiberglass cloth to present a smooth surface.
   5. Apply mastic to a wet film thickness of 3/64".
   6. Fabric shall not be visible after completion.
   7. Vapor seal flanges, valves and fittings with Childers CP-35.

B. PVC fitting covers are not acceptable.

3.4 ALUMINUM JACKETING (Insulated Piping Outdoors Above Grade)

A. Apply smooth aluminum jacket on piping, valves, fittings and flange covers according to manufacturer's recommendations, using stainless steel strapping and seals, to provide weather tight covering and to shed water.

B. Aluminum jacketing is not considered as contributing to the vapor barrier or the insulation jacket. The vapor barrier must be sufficient in itself for this function. Lap each adjoining jacket section a minimum of 3" to make a weather tight seal.

C. Install straps on 9" centers and at each circumferential lap joint.

D. Cover and seal all exposed surfaces.

E. The use of screws and rivets is not approved.

F. Provide isolation (30# felt) between the aluminum jacket and the sheetmetal protection shield at each pipe support point.

3.5 CONCEALED STORM DRAIN PIPING

A. Provide flexible glass fiber insulation with factory-applied, reinforced UL labeled Foil-Skrim-Kraft (FSK) facing. Install insulation of clean, dry piping.

B. Insulation shall be wrapped tightly on the piping with all circumferential joints and longitudinal joints overlapped a minimum of 2" with facing to the outside to obtain specified R-value using a maximum of 25% compression.

C. Provide vapor retarder at penetrations, joints, seams and damage to the facing with staples and FSK foil tape. The facing shall be taped with a minimum 3" wide strip of reinforced foil tape. Pressure-sensitive tape shall be a minimum 3" (76mm) wide and shall be applied with moving pressure using an appropriate sealing tool. Staples shall be outward cinch and placed 6" (152mm) on center.

D. Mechanical / Electrical rooms and above ceilings are considered concealed spaces.

3.6 MISCELLANEOUS

A. Install materials after piping has been tested and approved.

B. Apply insulation on clean, dry surfaces only.

C. Apply weather protective finish on elastomeric insulation installed in non-conditioned spaces. Provide a minimum of three coats.

3.7 INSULATION THICKNESS

INSULATED UNIT	THICKNESS (Inches)
Exposed Roof Drain Bodies and Horizontal Roof Drain Leaders	1
Exposed Roof Overflow Drain Bodies and Horizontal Drain Leaders	1
Domestic Cold Water/Make-Up Water Piping/Drinking Chilled Water	1
Horizontal Sanitary Drain Piping Which Receives Condensate	1
Domestic Hot Water Piping, 1-1/2" Pipe and Smaller	1
Domestic Hot Water Piping, 2" Pipe and Larger	1-1/2

END OF SECTION

SECTION 22 11 16

DOMESTIC WATER PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install domestic hot and cold water piping.

1.2 RELATED WORK

A. Division 22 Plumbing
   1. Valves, Strainers and Vents
   2. Pipe and Pipe Fittings - General
   3. Plumbing Piping Insulation
   4. Plumbing Fixtures and Fixture Carriers

PART 2 - PRODUCTS

2.1 PIPING AND FITTINGS

A. Below Slab on Grade Piping for Water Entries:
   1. 1-1/2-inch and smaller, provide ASTM B88 Type K (heavy wall) annealed tempered (soft) seamless copper water tube. No joints below slab entries.
   2. 2-inch and larger, provide Watts (Ames) IBR and IBR 2 304 stainless steel one piece in-building riser.

B. Below Grade Piping Outside Building (beyond 5'-0" of building): Provide PVC water main pipe 4 inch through 12 inch in diameter in conformance with AWWA C900. When using 3" or smaller provide Schedule 80 PVC ASTM D1785 with ASTM D-2466 socket type fittings. Provide fittings in conformance with ASTM 2466. Furnish pipe with a minimum pressure rating of 150 lbs. per square inch. Provide PVC pipe as manufactured by Johns-Manville, CertainTeed, Clow or approved equal.

C. Below Slab on Grade Piping. Furnish ASTM B 88 and ANSI/NSF Standard 61 annealed tempered (soft), Type K copper water tube. Run continuous with no joints under the floor slab. Provide copper pipe corrosion protection as specified in this Section.

D. Above Slab Piping. Provide seamless ASTM B 88 and ANSI/NSF Standard 61 drawn tempered (hard) Type L copper water tube with wrought copper or bronze fittings with solder-joints, ANSI B16.22. Solder material shall be 95-5 (lead free) (Tin-Antimony-Grade 95TA) ASTM B 32.

E. Unions. Provide 150 lb. standard unions with ground joint and bronze seat. Flange joints larger than 2 inches. Provide dielectric isolating unions at junctions or connection between metallic piping of dissimilar metal. Provide pipe threads with standard taper pipe threads ANSI B2.1.

F. Alternate Method of Joining Copper Pipe and Tubing: Press Fittings: Copper press fitting shall conform to the material and sizing requirements of ASME B16.51. O-rings for copper press fittings shall be EPDM. VIEGA. The system intended for use shall be approved by submittal. Systems from various manufacturers may vary in technology. The field personnel shall carry training credentials from the approved manufacturer for the project. Mixing of fittings from different manufacturers is strictly prohibited.

2.2 WATER HAMMER ARRESTORS

A. Provide piston type hydraulic engineered/manufactured water hammer arrestors in cold and hot water supply lines in chases or walls to each fixture branch or battery of fixtures serving quick closing valves of electrical, pneumatic, spring loaded type, or quick hand closure valves on fixture trim. Provide water hammer arrestors at the end of the branch line between the last two fixtures served. Provide Precision Plumbing Products, Inc., or equal. Size units according to water hammer arrestor's Standard PDI WH-201; refer to schedule on drawings.

B. Install all water hammer arrestors so as to attain 100% effectiveness according to Plumbing and Drainage Institute PDI-WH201 Table 5, 6 and 6-A for water hammer arrestors.

C. All water hammer arrestors shall be installed in a vertical position.

D. All water hammer arrestors shall be accessible and shall have access panels where required. Arrestors located above ceilings in fixture drops will not be acceptable. Refer to sizing and placement data as indicated in PDI Standard PDI-WH-201.

PART 3 - EXECUTION

3.1 DRAINAGE

A. Install water piping systems with uniform horizontal grade of 1/8 inch per 10 foot, minimum, to low points to provide complete system drainage. Where constant pitch cannot be maintained for long runs, establish intermediate low points and rise to new level. Grade branches to drain to mains or risers. Unless otherwise indicated, terminate low points of risers with drain valve piped to nearest hub or floor drain.

3.2 STERILIZATION

A. Prior to starting work, verify system is complete, flushed and clean.

B. Inject chorine disinfectant in liquid, powder, tablet or gas form throughout the system to obtain 50 to 80 Mg/L residual.

C. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 20% of the outlets.

D. Retain disinfectant in system for 8 hours (minimum), 24 hours (maximum). During the disinfection process, operate all valves and accessories.

E. If final disinfectant residual tests less than 25 Mg/L, repeat treatment.

F. Flush disinfectant from system until chemical and bacteriological tests prove water quality equal to that of the service main.

G. Take samples no sooner than 24 hours after flushing from at least 10% of the outlets and from the water entry.
   1. Obtain a minimum of one water sample flushing from at least 10% of the outlets and from the water entry.
   2. Take samples from faucets located at highest point in the building, and farthest point from the main water supply.

H. After final flushing, remove aerators, clean and replace.

I. Chemical and bacteriological tests shall be conducted by a state certified laboratory.

J. The firm performing the disinfection shall have chemical laboratory experience.

K. Provide a laboratory report to indicate the following information.
1. Name and address of the approved laboratory testing the samples.
2. Name and location of the project and date the samples were obtained.
3. Mg/L chlorine during retention.
4. Mg/L chlorine after flushing.
5. The coliform organism count. (An acceptable test shall show absence of coliform organisms.)

L. If analysis does not satisfy the specified minimum requirements, repeat the disinfection procedure.

M. Submit for approval to the Architect/Engineer a copy of the laboratory report and the certification of performance. An approved copy of each document shall be inserted in the Owner's manual.

3.3 UNDERGROUND WATER PIPING SYSTEM PROCEDURES

A. Lay sewer and water lines in separate trenches, separated by 10 foot of undisturbed or compacted soil.

3.4 TESTING

A. Test under a cold water hydrostatic pressure of 1-1/2 times operating pressure (150 psig minimum) and carefully check for leaks. Repair leaks and retest system until proven watertight.

B. Test the domestic water piping system at 150psig hydrostatic pressure, maintained for 6 hours.

C. Use only potable water for the test.

D. Perform the test before fixtures, faucets, trim or final connections are made to equipment.

E. If the system is tested in sections, the entire domestic water piping system shall be submitted to a final test, employing the specified procedure.

F. Do not insulate or conceal piping systems until tests are satisfactorily complete.

G. If any leaks or other defects are observed, suspend the test and correct the condition at once. Repeat testing until leaks are eliminated and the full test period is achieved.

H. The satisfactory completion of testing does not relieve the Contractor of responsibility for ultimate proper and satisfactory operation of piping systems and their accessories.

3.5 COPPER PIPE CORROSION PROTECTION

A. Corrosion protect copper tube piping systems:
1. In the building slab.

2. Beneath the building slab.
3. Buried.
4. Route plasti-sleeve 0.006 thick material entire length of below slab on grade copper tubing.

B. Cover copper tubing piping system with:
1. "Tapecoat" TC Primer.
2. "Tapecoat" CT cold applied coating tape.

C. Install coating system as specified by the manufacturer.

D. Extend the corrosion protection 2 inches above concrete slab on grade.

3.6 TEST OF PIPE CORROSION PROTECTION SYSTEM

A. Test the pipe corrosion protection coating with an approved high voltage tester adjusted to provide sufficient voltage to produce a spark through a pinhole in the coating (at least 15 kv AC).

B. Make repairs to small holes in accordance with the manufacturer's instructions.

C. Retest the repairs using procedures listed above.

D. Furnish certificate of compliance with field testing in Owner's manual.

END OF SECTION

SECTION 22 11 23

DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. General characteristics for pumps specified in Division 22 - Plumbing.

1.2 RELATED WORK

Requirements for pumps are specified in other sections of Division 22 - Plumbing, including the following:

A. Division 22 Plumbing - Electrical Provisions of Plumbing Work.

1.3 PUMP SELECTION

A. Select pumps conservatively for scheduled conditions. Furnish pumps that have reasonably high efficiencies, with peak efficiency at or near rated conditions. Select pumps that will operate stably at 15' suction lift despite substantial reduction in head or substantial increase in delivery.

B. If the pumps proposed are not considered suitable, submit manufacturer's data on other pumps, for review.

C. Scheduled design flow, design head, pump efficiency, and motor horsepower are the minimum acceptable.

D. The pump curve shall rise continuously from maximum flow to cut-off.

E. Shut-off head approximately 10 percent greater than design head, unless otherwise indicated in pump schedules.

F. Pump brake horsepower shall not exceed the motor horsepower rating over the entire operating range from shut-off to run-out.

G. Select the pump for operation at or near peak efficiency.

H. Cavitation-free at all points on the curve.

I. Impeller diameter shall not exceed 90 percent of the maximum published diameter.

1.4 PUMP SIZE AND TYPE

A. Provide motor-driven pumps of the type and speed scheduled. Select pumps that are not overloaded throughout the entire range of pump operation. Provide pump connection sizes as indicated.

B. Submit copies of manufacturer’s performance curves, as shop drawings on each pump. Clearly mark the curves for each pump to indicate the diameter of the impeller and the selection point.

1.5 CERTIFIED DATA

A. Submit factory certified pump curves showing pump performance characteristics with pump and system operating points plotted. Curves shall include as a minimum, flow (gallons per minute), head (feet of water), all available impeller diameters (inches), efficiency (percent), net positive suction head required (feet of water), brake horsepower, pump size and pump model. Show pump curves with system curve plotted.

PART 2 - PRODUCTS

2.1 DOMESTIC HOT WATER CIRCULATOR

B. Provide each pump with a mechanical seal. Use seal materials suitable for the pumped liquid.

C. Paint entire unit with two coats of machinery enamel after completion of installation.

D. Pump motor:
1. NEMA Standard
2. Open drip proof
3. 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.
4. Provide insertion thermostat (Aquastat) or (timer) to control operation of the domestic hot water return pumps.

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. Amtrol/Thrush
3. Armstrong
4. Aurora
5. Grundfos

2.2 DOMESTIC HOT WATER CIRCULATING PUMPS (SMALL) FRACTIONAL HORSEPOWER

A. Pump Construction:
1. Wet-rotor, in-line, single stage
2. Bronze housings with ½” and ¾” sweat connections
3. Stainless steel housing with union threaded connections
4. Integrated check valve inside union fitting on a sweat pump housing
5. Built-in 5-foot, 115 volt AC line cord with NEMA 3 Prong male plug or line cord
6. Built-in timer
7. Aquastat thermostatic control

B. Acceptable manufacturers:
1. Bell & Gossett
2. Taco
3. Grundfos

2.3 SUBMERSIBLE SUMP PUMPS AND SEWAGE EJECTORS

A. Pump Construction:

1. Hermetically sealed motor
2. Positive action air operated diaphragm switch
    a. High water alarm contact
    b. Use three-float system with duplex pump set-up with float for lag pump (signals high level alarm)
3. Housing and base cast iron construction

B. Provide an alarm terminal cabinet.
1. In the event of a high water alarm, energize a pulsing 2" diameter red signal light with graphic "sump pump high water alarm”.
2. High level alarm must be connected to Cy-Fair Police Department.

C. Test the sump pump package by operation of the completed system through four cycles of operation.
1. Fill the sump to operational levels
2. Visually check level controls
3. Pump operation
4. Verify absence of piping leaks, sump leaks, excessive noise, and excessive vibration
5. Verify alarms
6. Verify pump capacity

D. Sump pump package capacity shall be as scheduled.

E. Acceptable Manufacturers:
1. Hydromatic
2. Auroa
3. Weil
4. Grundfos

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 access space around pumps for service.
2. Lubricate pumps prior to start-up.
3. Install hot water circulator horizontally, properly supported to wall, in an accessible location for testing and maintenance at a height not to exceed 60” above finished floor. Install line size Ernst bronze rotating wheel, flow indicator with double window, downstream of circulator.

B. Provide a line size isolation valve and strainer on the pump suction and a line size silent check valve and balancing valve on the pump discharge.

C. Support piping adjacent to the pump such that no weight is carried on the pump casing. Decrease from pipe size with eccentric reducer on suction side and concentric increaser on discharge side.

D. Ensure pumps:
   1. Operate at specified system fluid temperatures without vapor binding and cavitation.
   2. Are non-overloading in parallel and individual operation.
   3. Operate within 25 percent of midpoint of published maximum efficiency curve.

E. Refer to pump detail on the Contract Drawings for piping accessories to be provided.

3.2 ALIGNMENT FOR BASE MOUNTED PUMPS

A. Set the pump on a concrete inertia base or concrete housekeeping pad as specified. Anchor, level and grout.

B. Align the pump and driver in accordance with Hydraulic Institute Standards for centrifugal, rotary and reciprocating pumps.

C. Realign the pump and driver after initial leveling of pump base before placing the grout and again after the grout has set and the foundation bolts are tightened. Recheck the alignment after the piping has been connected.

3.3 MANUFACTURER START-UP SERVICE ALIGNMENT

A. After installation, the pumps and motors are to be aligned by the manufacturer or their representative utilizing a dial indicator. After completion, a formal report must be submitted by the Manufacturer to the Engineer prior to final acceptance. This report must include pump serial number, location, beginning and final alignment at a minimum.
   1. Technicians, as required, shall be trained and experienced in the work they perform (Contractor start-up / alignment is unacceptable).

B. Before starting pumps, but after connecting piping:
   1. Align shafts and coupling with a precision dial indicator alignment instrument to the minimum tolerances .004 (TIR) per inch of coupling radius or as recommended by the manufacturer, whichever is the greater.
   2. Tabulate the actual pump alignment reading with manufacturer's minimum tolerances.
   3. Submit readings for approval.
   4. Include the approved readings in the Owner's Maintenance Manual.

3.4 FINAL PUMP FLOW CALIBRATION

A. Based on the results of the final phases of the test and balance sequences, if the flow of the unthrottled pump is more than 10% above the scheduled values:
   1. Request detailed instructions from the pump manufacturer for the correct impeller diameter.
   2. Trim the impeller to the diameter recommended by the manufacturer, employing precision machinery.

B. Enter the information on the final configuration of the pump in the Owner's Manual.
   1. Modify the pump nameplate to reflect the correct head and flow data and the impeller diameter.

3.5 SPARE PARTS

A. Provide the following spare parts and material to the Owner for his use after the warranty period.
   1. A mechanical seal for each pump
   2. A set of bearings for each pump

END OF SECTION

SECTION 22 13 16

SOIL, WASTE AND SANITARY DRAIN PIPING, VENT PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install piping in buildings and underground laterals to 5 foot outside of building.

1.2 RELATED WORK

A. Site Work:
   1. Sanitary Sewers
   2. Excavation, Trenching and Backfilling for Utilities

B. Division 22 Plumbing:
   1. Pipe and Pipe Fittings
   2. Plumbing Fixtures and Fixture Carriers
   3. Drains, Cleanouts and Hydrants
   4. Earthwork

1.3 REFERENCES

A. CISPI - Cast Iron Soil Pipe Institute

B. ASTM - American Society for Testing and Materials

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. All No-Hub clamps must have 4 bands minimum. Sizes 5” through 10” shall have six bands minimum.
   1. No-Hub Clamps – Sanitary Waste:
      a. Husky SD 4000
   2. No-Hub Clamps - Vents
      a. Husky SD – 2000
      b. Mission Rubber Co., LLC Heavy Weight Couplings

B. Provide Anaco-Husky shielded couplings Series 4200 with one piece neoprene gasket for all cast iron pipe transitions to Schedule 40 DWV pipe penetrations through slabs. Sizes 1-1/2” through 8” Series 4200.

C. Cast Iron Soil Pipe and Fittings:
   1. AB&I
   2. Charlotte Pipe and Foundry Co.
   3. Tyler Pipe / Soil Division

2.2 DRAIN PIPE AND FITTINGS

A. Above Slab Pipe:
   1. No-hub cast iron soil pipe and fittings shall conform to CISPI 301 and ASTM A888.

2. Pipe shall conform to ASTM A74.
3. No-hub couplings shall meet or exceed the latest specification standard CISPI 310 or ASTM C-1540 and conform to FM 1640. CISPI 310 Couplings shall be listed by NSF International.
4. Rubber Gaskets for cast iron soil pipe and fittings shall conform to ASTM C564
5. All Cast Iron Soil Pipe and Fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute

B. Below Slab on Grade Piping:
1. Schedule 40 PVC plastic pipe and DWV fittings. 4" SDR pipe is not allowed.
2. Solvent welded DWV joints shall conform to IAPMO Installation Standard IS-9.
3. Pipe and fittings shall conform to ASTM D 1784, ASTM D 1785, ASTM D 2665, ASTM D 3311 and NPS Standard 14 & 61.

C. Below Slab on Grade Piping for Grease Waste as indicated on Drawings:
1. Schedule 40 CPVC pipe and fittings
2. Solvent welded DWV joints shall conform to ASTM D3311 and be produced to dimensions specified in ASTM F 2618, NSF International, UPC, IAPMO IGS 210 and International Plumbing Code.
3. Solvent Cement, Heavy Body; mustard yellow color, as tested by ASTM F 2618 / ASTM F493
4. Manufacturer: Spears (only)

2.3 VENT PIPE AND FITTINGS

A. Above Slab Pipe:
1. No-hub cast iron soil pipe and fittings shall conform to CISPI 301 and ASTM A888.
2. Pipe shall conform to ASTM A74.
3. No-hub couplings shall conform to CISPI 310 and shall be listed by NSF International
4. Rubber gaskets for cast iron soil pipe and fittings shall conform to ASTM C564

B. Below Slab on Grade Piping:
1. Provide Schedule 40 PVC with DWV fittings with solvent welded joints. Pipe and fittings shall conform to ASTM D1784-82.

C. Above Slab Pipe.
1. Drainage-waste-vent copper pipe and fittings for waste stub-outs for all fixture locations and equipment discharge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All above and below slab soil, waste, sanitary drain and vent piping installation methods shall be in accordance with Cast Iron Soil Pipe Institute Standards.

B. Above ground installation in the horizontal position shall be supported at every hub (hub & spigot or hubless type). Hangers are to be placed within 18" of hub or coupling. For large diameter fittings, 5 inches and larger shall be braced to prevent horizontal movement. Every branch opening or change of direction, braces, blocks, rodding or

other suitable method shall be used to prevent movement. Riser clamps to be used for each floor, not to exceed 15'-0".

C. All above and below slab PVC sanitary waste and vent piping installation methods shall be in accordance with IAPMO Installation Standard 18-9 for Schedule 40 PVC-DWV, per manufacturer's recommendations and applicable standards.

D. Tracer wires shall be installed on all underground PVC sanitary sewer lines installed outside the building slab.

E. All PVC underground shall be installed in accordance with ASTM D2321.

3.2 GRADE

A. Give horizontal pipe grade of ¼-inch per foot where possible, but not less than 1/8 inch per foot unless otherwise shown.

3.3 DRAIN PIPE AND FITTINGS

A. Offsets and Fittings.
   1. Use reduction fittings to connect two pipes of different diameter.
   2. Change directions by appropriate use of 45-degree wyes, long-sweep quarter-bends, and sixth-, eights-, and sixteenth-bends. Sanitary tees can be used on vertical stacks. Use long sweeps at the base of risers.
   3. Provide a separate trap at each fixture, unless a trap is built into the fixture. Provide a deep seal trap at each floor drain and hub drain. Place traps so that the discharge from any fixture will pass through only one trap before reaching a building drain.
   4. Do not use double combinations or cross fittings below slab.
   5. Refer to Sanitary Drainage Code section for acceptable fittings to be used for changes in direction of drainage flow. Double combo sanitary fittings or double wye and 1/8th bend fittings are not allowed for horizontal to horizontal piping systems per Code.

B. Hub Drains. Install hub drains where indicated, with the top of the hub 1/2 above the finished floor, unless otherwise indicated on the drawings.

C. Cleanouts. Install cleanouts the same size as the soil waste lines in which the cleanouts are placed; however, no cleanout should be larger than 4 inches in diameter.
   1. Where cleanouts occur in pipe chases, bring the cleanouts through the walls and install covers. Where cleanouts occur in floor slabs, set flush. Reference drawing schedule.
   2. Provide cleanouts where soil lines change direction, every 75 foot on long runs, or as shown on the drawings, at the end of each horizontal waste line, and at the base of each riser (and at each increase in pipe size).
   3. Cleanouts shall occur at the end of each battery of water closets, urinals, lavatories, sinks, and single water closets. Cleanouts shall be installed so as to access the main sanitary or soil line. Extend and offset above flood rim of water closet.
   4. Double sanitary tees and double quarter bends do not allow for easy access to main lines, therefore these types of fittings are not allowed.
   5. Provide cleanout above all sanitary cross fittings and Figure 5 fittings in chase walls, etc.
   6. Do not provide gasket markers in carpeted areas. Do provide full cleanouts

with top fully exposed.

7. For large garbage disposers in kitchens, install a cleanout between the disposer and the P-trap and at the wall.
8. Notify civil to have manholes at connections to main at each exit point.

D. Floor Drains. Locate floor drains 1/2-inch below finish floor elevation unless otherwise shown.

3.4 VENT PIPING

A. Make vent connections to vent stacks with inverted wye fittings. Extend full-size vents through the roof to at least 6 inches above the roof.

B. Flash the roof penetration with 6 lb. lead flashing approximately 24 inches square. Flange the flashing to the lead sleeve. Extend the flashing up and around the vent pipe. Turn the flashing down inside the pipe at least 2 inches to make a watertight joint. Flashing shall comply with the roofing manufacturer's requirements. Reference the Architectural Drawings for exact requirements.

C. Locate vent piping through roof a minimum horizontal distance of not less than 20 feet from any air intake opening or supply fan.

D. During demolition, abandoned plumbing vents are to be removed in their entirety. Do not cap the vent pipes below the roof deck and abandon in place. The hole in the roof is to be patched and made water tight.

3.5 TESTING

A. Below Slab on Grade and All Floors in Multi-Story Buildings:

1. Test pipe below slab on grade before backfilling and connecting to city sewers.
2. Maintain not less than 10 foot of hydrostatic head for1 hour without a leak.
3. Before acceptance of the work the contractor must ensure the piping is in working order before and after the slab is poured. To ensure this the contractor must test completed systems in the presence of the Architect, Engineer and authorities having jurisdiction after installation is complete.
4. Maintain the test on the system till after the slab is poured. Provide an accessible connection that may be reviewed by Architect, Engineer and authorities having jurisdiction prior to and after the slab is poured.
5. Test drainage piping systems in accordance with governing codes and the requirements specified. Provide equipment and materials and make test connections required to execute tests.
6. Test drainage and waste piping hydraulically by filling system to its highest point or, whichever is greater, at a static head of 10 feet. Leaks at any joint shall be sufficient cause for rejection.
7. Air tests may be substituted for hydraulic tests by forcing air into the closed system at a uniform pressure sufficient to balance a column of 10 inch hg in height.
8. Under any of the previously described tests, the water height shall remain constant, after stabilization, for not less than 15 minutes without any further addition of water.

B. System Test. After the various sections of soil, waste and vent piping are installed, but before fixtures are connected, test the system by:

1. Plugging outlets.

2. Filling vertical sections of multiple story buildings of not less than three floors at a time with water. Provide wyes as required to facilitate plugging.
3. Test for 6 hours without any drop in the water level.

3.6 RODDING SEWERS

A. All sanitary soil and waste lines, both in the building and out, shall be rodded out and flushed out after completion of construction and prior to finish floor being installed. All work must be completed prior to substantial completion. All floor drains and cleanout locations must be included in this work.

B. All sanitary soil and waste lines below building 3" and larger shall be internally videotaped at time of substantial completion and on existing piping prior to construction. All videotaping shall include on-screen date and time and include audio narration. All videotaping shall be provided by experienced individual in videotaping piping systems. CFISD must be notified 24 hours prior to start time of video inspection. An Owner's Representative, CFISD plumbing foreman, or his designee shall be present during video-taping. Three copies of the videotape shall be delivered to the Owner for future records.

C. This work shall be done in the presence of the Owner's Representative, CFISD plumbing foreman, or his designee as part of the Contract, to ensure all lines are clear, and any obstruction that may be discovered shall be removed immediately. Rodding shall be accomplished by utilizing the proper rotary head to clear sewer. Pipe sizes 8 inches and larger shall be hydro-flushed.

3.7 SMOKE TESTING – LIQUID SMOKE SYSTEM

A. Interior Plumbing Piping:
1. Contractor shall perform smoke testing for finding leaks in all interior of building sanitary sewer piping, acid waste and vent piping, and sanitary vent piping above and below building slab prior to cover up.
2. Contractor must use a laboratory tested safe liquid smoke with a patented liquid smoke generating system. The liquid smoke must be contained in a pressure tank with inline filter and quick disconnect.
3. Contractor shall provide a continuous smoke flow for testing the entire piping system in lieu of partial testing done by sections at a time. Partial testing will not be acceptable.
4. Smoke generating system must generate up to 3 hours or more of continuous and constant smoke. Generating system must have a metering valve to precisely control smoke flow and density. Smoke generating system must have a 4" x 6" industrial flexible mining duct for connection to vent stack or cleanout or sit atop a manhole outside.
5. Smoke generating system must be power full enough to push smoke through the smallest leaks.
6. The liquid smoke must not leave any stains or odors.
7. The liquid smoke shall not contain Zinc Chloride, a listed toxic compound in OSHA 1915,1000 – Air contaminants.
8. Smoke generating system must have a means to atomize the liquid smoke and have an enclosed fan system capable of up to 700 cfm with adjustable inlet damper control to adjust cfm as necessary for the size of system.
9. Provide Hurco "Power smoker "with Hurco "LiquiSmoke" system or approved equal. No smoke bombs allowed.
10. All plumbing fixtures must be installed including floor drains with wetted trap seals.

11. Smoke testing shall be performed after completion of any videotaping, rodding or flushing of the sanitary system. Test must be performed prior to ceiling installation in new construction projects. Smoke is usually injected into the building through the two-way cleanout in the main sewer line leaving the building or a plumbing roof vent or fixture. Plug piping as necessary as to force all smoke into building. Smoke can also be admitted through a manhole. Smoke will travel through the sanitary sewer and vent system and through the air spaces in the sewer lines and emanate from any leaks in the system. The smoke must reach the last roof vent in the system to indicate the entire system has been completely filled with smoke. The smoke must travel the full length of the piping system. Contractor must provide manpower as necessary to visually trace the flow of smoke through the wall cavities, annular floor/ceiling spaces, inject the smoke, observe the roof vents and to identify the integrity problems.
12. Contractor shall provide a detailed list of findings and a drawing indicating the location, fixture type, type and size of pipe, and or description of type of problems found.
13. Typical findings from indoor smoke testing may include:
    a. Dry traps in floor drains
    b. Improperly capped sewer lines or vents
    c. Broken sewer lines or vents
    d. Cross connected sewer vents and drains
    e. The drawing of air emanating from sewer vents into intakes of air exchange systems
    f. Poorly glued pipe joints
    g. Loose no-hub couplings
14. An Owner's Representative shall be present during smoke testing.

END OF SECTION

SECTION 22 14 13

ROOF DRAINAGE PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install roof drains, drain pipes and accessories.

1.2 RELATED WORK

A. Division 22 Plumbing
   1. Pipe and Pipe Fittings - General; for general piping requirements.
   2. Drains and Cleanouts.
   3. Plumbing Piping Insulation.
   4. Earthwork

1.3 REFERENCES

A. CISPI – Cast Iron Soil Pipe Institute

B. ASTM – American Society for Testing and Materials

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Cast Iron Soil Pipe and Fittings
   1. AB&I
   2. Charlotte Pipe and Foundry Co.
   3. Tyler Pipe / Soil Division

2.1 STORM PIPE AND FITTINGS

A. Above Ground Pipe. Provide service weight cast iron Hub and Spigot soil pipe and fittings with compression type neoprene gaskets that conform to ASTM C-564. Pipe and fittings shall meet the requirements of ASTM A 74. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute.

B. Below Slab on Grade: Provide Schedule 40 PVC plastic pipe and DWV fittings with solvent welded joints. Pipe and fittings shall conform to ASTM D 1784-82.

C. Provide Anaco-Huksy shielded couplings, Series 4200 with one-piece neoprene gasket for cast iron pipe transitions to Schedule 40 DWV pipe penetrations through slabs. Sizes 2” through 8” use Series 4200.

D. All no-hub couplings connections to roof drains to piping must be located below the metal decking.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All above and below slab storm piping installation methods shall be in accordance with the Cast Iron Soil Pipe Institute Standards.

B. Above ground installation in the horizontal position shall be supported at every hub (hub & spigot or hubless type). Hangers to be placed within 18” of hub or coupling. For large diameter fittings, 5 inches and larger shall be braced to prevent horizontal movement. Every branch opening or change of direction, braces, blocks, rodding or other suitable method shall be used to prevent movement. Riser clamps to be used for each floor, not to exceed 15’-0”.

C. All above and below slab PVC storm piping installation methods shall be in accordance with IAPMO Installation Standard 18-9 for Schedule 40 PVC-DWV, per manufacturer’s recommendations and applicable standards,and in accordance with ASTM D2321.

3.2 GRADE

A. Give horizontal lines minimum grade of 1/8 inch per foot.

3.3 TESTING

A. Below Slab on Grade and All Floors in Multi-Story Buildings:
1. Test pipe below slab on grade before backfilling and connecting to city sewers.
2. Maintain not less than 10 foot of hydrostatic head for1 hour without a leak.
3. Before acceptance of the work the contractor must ensure the piping is in working order before and after the slab is poured. To ensure this the contractor must test completed systems in the presence of the Architect, Engineer and authorities having jurisdiction after installation is complete.
4. Maintain the test on the system till after the slab is poured. Provide an accessible connection that may be reviewed by Architect, Engineer and authorities having jurisdiction prior to and after the slab is poured.
5. Test drainage piping systems in accordance with governing codes and the requirements specified. Provide equipment and materials and make test connections required to execute tests.
6. Test drainage and waste piping hydraulically by filling system to its highest point or, whichever is greater, at a static head of 10 feet. Leaks at any joint shall be sufficient cause for rejection.
7. Air tests may be substituted for hydraulic tests by forcing air into the closed system at a uniform pressure sufficient to balance a column of 10 inch hg in height.
8. Under any of the previously described tests, the water height shall remain constant, after stabilization, for not less than 15 minutes without any further addition of water.

B. System Test. After the various sections of soil, waste and vent piping are installed, but before fixtures are connected, test the system by:
1. Plugging outlets.
2. Filling vertical sections of multiple story buildings of not less than three floors at a time with water. Provide wyes as required to facilitate plugging.
3. Test for 6 hours without any drop in the water level.

END OF SECTION

SECTION 22 15 00

SHOP COMPRESSED AIR SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install compressors, pipe and fittings for compressed air systems.

1.2 RELATED WORK

A. Division 22 Plumbing
   1. Control air compressors and control air piping; Control Section.
   2. Pipe and Pipe Fittings.
   3. Valves, Strainers and Vents.
   4. Vibration Isolation.

B. Division 26 - Electrical - Motors.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Provide ASTM B 88, Type K, hard-drawn copper water tube with wrought copper solder fittings, ANSI B16.22.

2.2 UNIONS AND FLANGES

A. Unions. Provide unions that are 150 lb. standard (300 lb. WOG) galvanized malleable iron, ground joint unions with bronze seat. Use flange joints for pipe larger than 3 inches in diameter.

2.3 VALVES

A. Pressure Reducing. Provide a spring-loaded valve, with semi-steel body and stainless steel inner valve, disc seat and disc spring, adjusting spring of corrosion-resistant steel and synthetic composition diaphragm.

B. Pressure Relief. Furnish spring-loaded, bronze body relief valves with enclosed spring. Use seats specially ground for compressed air service, with trip lever.

C. Gate Valves. 2-1/2 inch & smaller, 150 lb., solid disc, union bonnet, rising stem; 3 inch and larger, 125 lb., OS&Y, IBBM.

D. Ball Valves. 1/2 inch through 2 inch, 150 lb., full port, bronze body, blow-out proof stem.

E. Check Valves. 2 inch & smaller, 300 lb. Bronze; 2-1/2 inch & larger, provide nonslam wafer type.

2.4 ACCESSORIES

A. Moisture Traps. Use float-operated moisture traps rated at 200 psi. Provide unit with 30

inch x 30 inch mesh screen, a full 1/4 inch drain orifice and self-cleaning drain seat. Traps used on air compressor drier, receiver and piping system shall be by same manufacturer. Install traps where shown and at all low points in the system.

B. Quick Couplings:
   1. Transportation Centers: Provide with ½-inch male NPT end with locking sleeve ½-inch standard hose end.
   2. School Shops and Labs: Provide with 1/4-inch male NPT end with ¼-inch standard hose end.

C. Filter. Provide 200 psig, clear bowl filter, with reusable felt filtering element capable of removing 5 micron-size particles.

D. Electronic Drain Valve: Automatic drain valve for moisture removal from receiver tank, 120 vac, Maximum Pressure 200 PSI, Adjustable Drain Cycle 5 min. to 24 hours with non-adjustable purge time 3.5 seconds. Dynaquip Controls AD1B ½"; Grainger Item #6W175.

PART 3 - EXECUTION

3.1 DRIP LEGS

A. Install a capped drip leg 6 inches long at the base of the vertical riser and at the ends of main piping runs with a valved drain. Pipe to the nearest floor or hub drain.

3.2 TESTING

A. Apply an air pressure 1-1/2 times the operating pressure, 150 psig minimum, to the system and test joints with a soap solution while lines are under pressure. Repair leaks and retest the system until pressure is maintained for four hours minimum.

END OF SECTION

SECTION 22 20 00

PLUMBING PIPE AND PIPE FITTINGS - GENERAL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install pipe and pipe fittings for piping systems specified in Division 22 - Plumbing.

1.2 RELATED WORK

A. Division 22 Plumbing
   1. Earthwork
   2. Valves, Strainers and Vents
   3. Insulation
   4. Other Piping Sections

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. The particular type of pipe and fittings for each system is specified in the individual sections.

2.2 JOINTS

A. Make screwed joints using machine cut USASI taper pipe threads. Apply a suitable joint compound to the male threads only. Ream the pipe to full inside diameter after cutting. All-thread nipples are not permitted.

B. Dissimilar Metals. Make joints between copper and steel pipe and equipment using insulating unions or couplings such as Crane Company #1259; EPCO as manufactured by EPCO Sales, Inc.; or an approved equal.

C. Solder joints.
   1. Prior to making joints, cut pipe square and ream to full inside diameter. Clean exterior of pipe and socket. Apply a thin coat of suitable fluxing compound to both pipe and socket, and fit parts together immediately.
   2. Heat assembled joint only as required to cause the solder to flow. Run the joint full, slightly beaded on the outside, and wipe to remove excess solder.
   3. Use silver brazing alloy or Sil-Fos on underground water entry piping. Use lead free solder on all other copper piping.

D. Make welded joints as recommended by the standards of the American Welding Society. Ensure complete penetration of deposited metal with base metal. Provide filler metal suitable for use with base metal. Keep inside of fittings free from globules of weld metal. The use of mitered joints is not approved.

E. Flanged.
   1. Prior to installation of bolts, center and align flanged joints to prevent mechanical pre-stressing of flanges, pipe or equipment. Align bolt holes to straddle the vertical, horizontal or north-south centerline. Do not exceed 3/64" per foot inclination of the flange face from true alignment.

2. Use flat-face companion flanges only with flat-faced fittings, valves or equipment. Otherwise, use raised-face flanges.
3. Install gaskets suitable for the intended service and factory cut to proper dimensions. Secure with manufacturers recommended gasket cement.
4. Use ANSI nuts and bolts, galvanized or black to match flange material. Use ANSI 316 stainless steel nuts and bolts underground. Tighten bolts progressively to prevent unbalanced stress. Draw bolts tight to ensure proper seating of gaskets.
5. Use carbon steel flanges conforming to ANSI B16.5 with pipe materials conforming to ASTM A 105 Grade II or ASTM A 108, Grade II, ASTM A 53, Grade B. Use slip-on type flanges on pipe only. Use welding neck type flanges on all fittings. Weld slip-on flanges inside and outside.
6. Keep flange covers on equipment while fabricating piping. Remove when ready to install in system.

F. No Hub. Hubless joints shall be made with wide body, neoprene sealing sleeve with stainless steel sleeve, coupling joints conforming to ASTM C 1277.
1. 4" pipe size and smaller coupling housing minimum of 3" width; 24 gauge Series 300 stainless steel with hi-torque clamps; neoprene coupling gasket.
2. 6" through 10" pipe size coupling housing minimum of 4" width.
3. Tighten clamps to within manufacturer's tolerances using preset torque wrench.

G. Compression Gasket System. Bell and spigot cast iron pipe 4" and smaller, use flax-base lubricant, Tyler Ty-Seal Lubricant or Charlotte Regular Lubricant. 6" and larger use a neoprene base lubricant, Charlotte Adhesive Lubricant.

H. Ring-Tite Joints: Furnish joints for installation according to manufacturer's recommendations. Provide adequate concrete thrust blocks at changes in direction, as recommended by manufacturer. JM Eagle pressure rated PVC water pipe. ASTM D2241 pressure rating, ASTM D3219 joints, gaskets ASTM F477.

I. Press fittings for copper pipe 1/2” to 4”: Copper press fittings shall conform to the material and sizing requirements of ASTM B16.18 or ASME B16.22. O-rings for copper press fittings shall be EPDM. Pro-Press System manufactured by VIEGA. The system intended for use shall be approved by submittal. Systems from various manufacturers may vary in technology. The field personnel shall carry training credentials from the approved manufacturer for the project. Mixing of fittings from different manufacturers is strictly prohibited.

2.3 UNIONS

A. Use 150 lb. standard (300 lb. WOG) malleable iron, ground joint unions with bronze seat. Provide flanged joints on piping 2-1/2" and larger.
1. Where pipe materials of different types join, use a dielectric union. Union shall be threaded, solder or as required for its intended use.

2.4 BRANCH CONNECTIONS

A. Pipe 2" and Smaller. For threaded piping, use straight size reducing tee. When branch is smaller than header, a nipple and reducing coupling or swagged nipple may be used.

B. 2-1/2" through 36": For welding piping, when branch size is the same as header size, use welding tee. Use Weld-o-let when branch is smaller than header. For threaded

branch connections, use 3000 lb. full coupling or Thread-o-let welded to header.

2.5 GASKETS

A. High Temperature Piping. Provide 1/16" thick ring gaskets of aramid reinforced SBR such as Garlock #3200 or 3400 or equal by Advanced Products and Systems.

B. Other Piping. Provide ring rubber gaskets, Garlock #7992 or equal by Advanced Products and Systems. Use 1/8" thick cloth reinforced neoprene gaskets. For smaller than 6", use 1/16" thick gasket.

2.6 FLOORS AND CEILING PLATES

A. Provide chrome-plated floor and ceiling plates around pipes exposed to view when passing through walls, floors, partitions, or ceilings in finished areas; size plates to fit pipe or insulation and lock in place.

2.7 DOMESTIC MANUFACTURE

A. All piping material, pipe and pipe fittings shall be manufactured in the United States of America unless specifically named in these specifications.

PART 3 - EXECUTION

3.1 PIPE FABRICATION AND INSTALLATION

A. Make piping layout and installation in the most advantageous manner possible with respect to headroom, valve access, opening and equipment clearance, and clearance for other work. Give particular attention to piping in the vicinity of equipment. Preserve the required minimum access clearances to various equipment parts, as recommended by the equipment manufactured, for maintenance.

B. Cut all pipes to measurement determined at the site. After cutting pipe, remove burrs by reaming. Bevel plain ends of ferrous pipe.

C. Install piping neatly, free from unnecessary traps and pockets. Work into place without springing or forcing. Use fittings to make changes in direction. Field bending and mitering is prohibited. Make connections to equipment using flanged joints, unions or couplings. Make reducing connections with reducing fittings only.

D. Install piping without tapping out of the bottom of pipe.

E. Press Connections: Copper press fittings ½” through 4” shall be applied in accordance with the manufacturer’s installation instructions. The tubing/pipe shall be fully inserted into the fitting and the tubing/pipe marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing/pipe to assure the tubing/pipe is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer. If soldering (thread adapters, etc.) near press fittings, take precautions to not damage the O-ring fittings. Maintain three pipe diameters or use a cooling agent. Viega-“Pro-Press”.

3.2 WELD

A. Weld and fabricate piping in accordance with ANSI Standard B31.1, latest edition, Code for Pressure Piping.

B. Align piping and equipment so that no part is offset more than 1/16". Set fittings and joints square and true, and preserve alignment during welding operation. Use of alignment rods inside pipe is prohibited.

C. Do not permit any weld to project within the pipe so as to restrict flows. Tack welds, if used, must be of the same material and made by the same procedure as the completed weld. Otherwise, remove tack welds during welding operation.

D. Do not split, bend, flatten or otherwise damage piping before, during or after installation.

E. Remove dirt, scale and other foreign matter from inside piping before tying into existing piping sections, fittings, valves or equipment.

F. Bevel ends of ferrous pipe.

3.3 OFFSETS AND FITTINGS

A. Due to the small scale of drawings, the indication of offsets and fittings is not possible. Investigate the structural and finish conditions affecting the work and take steps required to meet these conditions.

B. Install pipe close to walls, ceilings and columns so pipe will occupy minimum space. Provide proper spacing for insulation coverings, removal of pipe, special clearances, and offsets and fittings.

3.4 SECURING AND SUPPORTING

A. Support piping to maintain line and grade, with provision for expansion and contraction. Use approved clevis-type or trapeze-type hangers connected to structural members of the building. Single pipe runs to be supported by approved clevis type hangers. Multiple pipe runs to be supported by approved trapeze type hangers. Do not support piping from other piping or structural joist bridging.

B. Provide supports both sides of elbows for pipe 6" and larger.

C. Support vertical risers with steel strap pipe clamps of approved design and size, supported at each floor. Support piping assemblies in chases so they are rigid and self-supported before the chase is closed. Provide structural support for piping penetrating chase walls to fixtures. On cold water pipe, supports shall be outside the insulation.

D. Where insulation occurs, design hangers to protect insulation from damage. Pipe saddles and insulation shields, where required, are specified in the appropriate insulation section and are sized in accordance with the schedule on the drawings.

E. Install trapeze hangers, properly sized, to support the intended load without distortion.

F. Use electro-galvanized or zinc plated threaded rods, nuts, washers and hangers.

G. At outdoor locations, all supports, brackets and structural members shall be hot-dipped galvanized.

H. Support spacing: As recommended by the project structural engineer and support

manufacturer, but not more than listed below. Not to exceed spacing requirements of smallest pipe.

Pipe Size	Copper & Steel Max. Support Spacing, Feet	Cast Iron Max. Support Spacing, Ft.	Minimum Rod Diameter, Inches
1" & smaller	6		3/8
1-1/4" & 1-1/2"	8	5	3/8
2"	10	5	3/8
3"	10	5	1/2
4" & 5"	10	5	5/8
6" and above	10	5	3/4

3.5 PIPE SUPPORTS

A. Provide P1001 or P 5000 Unistrut metal framing members and appurtenances for pipe support. Hot-dip galvanize members and appurtenances when located outside. Sagging of pipes or supports is not acceptable.

B. Adjustable clevis hangers shall be used for single pipe supports; Anvil Fig. 260. When oversized clevis is used, a nipple shall be placed over the clevis bolt as a spacer to assure that the lower U-strap will not move in on the bolt. Provide adjustable clevis with a nut / washer above and below the hanger on the support rod. Ring type clevis hangers are not acceptable.

C. Provide Anvil Figure 45 galvanized or primed and painted channel assembly for trapeze hangers.

3.6 PIPE SUPPORTS ON ROOF

A. Support gas pipe on roof with Portable Pipe Hanger Model PP-10 with roller and fully adjustable height throughout pipe run. Base material shall be high density / high impact polypropylene with UV inhibitors and anti-oxidants. Provide with hot dip galvanized rod finish and framing. Nuts and washers shall be hot dip galvanized.

3.7 ANCHORS

A. Provide anchors as required. Use pipe anchors consisting of heavy steel collars with lugs and bolts for clamping to pipe and attaching anchor braces. Install anchor braces in the most effective manner to secure desired results. Do not install supports, anchors or similar devices where they will damage construction during installation or because of the weight or the expansion of the pipe. When possible, install sleeves in structural concrete prior to pouring of concrete.

3.8 FLOOR PENETRATIONS

A. At locations where pipe passes through floors, provide watertight concrete curb around penetration.

3.9 PIPE SLEEVES

A. Sleeves through masonry and concrete construction:
   1. Fabricate sleeves of Schedule 40 galvanized steel pipe.
   2. Size sleeve large enough to allow for movement due to expansion and to provide continuous insulation.

B. Sleeves through gypsum wall construction.
   1. Fabricate sleeves of 16 gauge galvanized sheet metal.

C. Sleeves through elevated slab construction.
   1. Fabricate sleeves of Schedule 40 galvanized steel pipe with welded center flange in floor.

D. Extend each sleeve through the floor or wall. Cut the sleeve flush with each wall surface. Sleeves through floors shall extend 2” above floor lines for waterproofing purposes. Slab on grade floors shall not be sleeved except where penetrating waterproofing membrane or insect control is required.

E. Caulk sleeves water and air tight. Seal annular space between pipes and sleeves with mastic compound to make the space water and air tight.

F. For sleeves below grades in outside walls, provide Thunderline Link-Seal or Advance Product and System Interlynx, with 316 stainless steel nuts and bolts, with cast iron pressure plate.

G. Provide chrome plated escutcheon plates on pipes passing through walls, floors or ceilings exposed to view. At exterior walls, stainless steel sheet metal is to be used.

H. For sleeves through fire and smoke rated walls, seal with a UL through-penetration firestop, rated to maintain the integrity of the time rated construction. Install in accordance with the manufacturer's installation instructions. Comply with UL and NFPA standards for the installation of firestops. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.

3.10 ISOLATION VALVES

A. Provide piping systems with line size shutoff valves located at the risers, at main branch connections to mains for equipment, to isolate central plant, and at other locations.

3.11 DRAIN VALVES

A. Install drain valves at low points of water piping systems so that these systems can be entirely drained. Install a line size drain valve for pipes smaller than 2" unless indicated otherwise. For pipes 2-1/2" and larger, provide 2" drain valves unless indicated otherwise. Drain valves shall be plugged when not in use and at completion.

3.12 CLEANING OF PIPING SYSTEMS

A. General cleaning of piping systems. Purge pipe of construction debris and contamination before placing the systems in service. Provide and install temporary connections as required to clean, purge and circulate.

B. Install temporary strainers at the inlet of pumps and other equipment as necessary

where permanent strainers are not indicated. Keep strainers in service until the equipment has been tested, then remove either entire strainer or straining element only. Fit strainers with a line size blow down ball valve and pipe to nearest drain. Blow down strainers, remove and clean as frequently as necessary.

C. Phase One: Initial flushing of system. Remove loose dirt, mill scale, weld beads, rust and other deleterious substances without damage to system components. Open valves, drains, vents and strainers at all system levels during flushing procedures. Flush until “potable water clear” and particles larger than 5 microns are removed.

D. Connect dead-end supply and return headers, even if not shown on the drawings, and provide terminal drains in bottom of pipe end caps or blind flanges.

E. Dispose of water in approved manner.

F. Phase Two: Cleaning of Piping Systems. Remove, without chemical or mechanical damage to any system component, adherent dirt (organic soil), oil, grease, (hydrocarbons), soldering flux, mill varnish, piping compounds, rust (iron oxide) and other deleterious substances not removed by initial flushing. Flush system and replace with clean water.

G. Phase Three: Final flushing and rinsing: Flush and rinse until “potable water clear” and particles larger than 5 microns are removed. Operate valves to dislodge any debris in valve body. Dispose of water in approved manner.

H. Submit status reports upon completion of each phase of work on each system.

3.13 TESTING

A. Test piping after installation with water hydrostatic pressure of 1-1/2 times operating pressure (150 psig minimum) and carefully check for leaks. Repair leaks and retest system until proven watertight.

B. Do not insulate or conceal piping systems until tests are satisfactorily complete.

C. If any leaks or other defects are observed, suspend the test and correct the condition at once. Repeat testing until leaks are eliminated and the full test period is achieved.

D. The satisfactory completion of testing does not relieve the Contractor of responsibility for ultimate proper and satisfactory operation of piping systems and their accessories.

3.14 PIPE MARKERS

A. Identify interior exposed piping and piping in accessible chases or plenums with Opti-Code Brady Pressure Sensitive Adhesive Pipe Markers, consisting of pipe marker and direction of flow arrow tape. Clean pipe prior to installation. Background colors of markers, arrows and tape for each type of system shall be the same. Meet ANSI/OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.

B. Identify exterior and mechanical room piping with Snap Around pipe markers through 4-inch pipe and Strap Around markers 5-inch pipe and larger. Pipe markers consisting of pipe marker and direction of flow arrow tape; background colors of markers, arrows and type for each type of system shall be the same. Meet ANSI / OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch

pipe and 4-inch letters for 5-inch pipe and larger.

C. Install identification in the following locations:
   1. Both sides of penetrations through walls, floors and ceilings.
   2. Close to valves or flanges.
   3. Intervals on straight pipe runs not to exceed 50 feet
   4. Apply marker where view is obstructed.

D. Pipe markers shall meet or exceed the specifications of the ASME A13.1 “Scheme for Identification of Piping Systems”.

END OF SECTION

SECTION 22 33 33

ELECTRIC WATER HEATER (Commercial ASME)

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Electric water heaters for domestic water systems.

1.2 RELATED WORK

A. Division 22 Plumbing
   1. Domestic Water Piping.
   2. Plumbing Piping Insulation.
   3. Division 26 Electrical.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Lochinvar.

B. State.

C. Rheem / Ruud

D. A. O. Smith

2.2 PRODUCTS

A. Provide electric water heaters with kilowatt, recovery ratings, and storage capacities as scheduled on drawings.

B. Provide an ASME code construction tank designed for 150 psig working pressure. Furnish glass-lined tank. Lining shall be corrosion-resistant.

C. Furnish factory-assembled, integral units equipped as follows:
   1. Immersion thermostat.
   2. High temperature limit switch (energy cutout).
   3. Low-water cutoff.
   4. Heavy duty UL rated for 100,000 cycles.
   5. Temperature and pressure relief valve.
   6. Anode rod.

D. Provide heavy-duty, medium watt density elements having nicoloy sheathing and prewired leads.

E. The entire vessel shall be enclosed in a round steel enclosure with baked enamel finish and shall enclose the tank with R-16 foam insulation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

B. All installations shall be in accordance with the manufacturer's published recommendations.

C. Furnish all supports required by the equipment included in this Contract.

D. Provide a 4" thick reinforced concrete housekeeping pad beneath heaters.

E. Furnish and install all necessary valves, traps, gauges, strainers, unions, etc. to facilitate proper functioning and servicing of equipment.
   1. Install a line size shutoff valve in cold water inlet and hot water outlet close to each heater.
   2. Provide a temperature gauge in the domestic hot water piping within five feet of outlet to each heater, upstream of all shut-off valves. Size and locate gauges to be easily readable from a standing position.

F. Provide dielectric isolation device where copper lines connect to ferrous lines or equipment, such as dielectric coupling or dielectric flange fitting.

G. Route condensate to a vented receiver.

H. Pipe relief valve discharge and all equipment drains indirectly to appropriate floor drain.

I. Set the operating and safety controls.

J. Set thermostats on domestic water heaters to delivery maximum water temperature as indicated on Contract Drawings.

K. Furnish and install an expansion tank on cold water supply to heater. Locate tank as close to water heater as possible between water heater and all check valves or backflow preventers. Expansion tank capacity shall be as scheduled on Contract Drawings. Install expansion tank in accordance with manufacturer's recommendations.

L. Install water heater in galvanized drain pan piped to floor drain. Elevate water heater tank bottom above drain pan as to not allow standing water inside of drain pan to touch bottom of tank.

3.2 STARTUP

A. Startup shall be performed by factory trained and authorized personnel. The factory representative shall also provide a technical and practical operation and maintenance training seminar including a hands-on operation and maintenance demonstration, and classroom presentation with handouts and visual aids, for no less than three physical plant personnel.

END OF SECTION

SECTION 22 34 32

GAS-FIRED DOMESTIC WATER HEATER (Cyclone)

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Gas-fired domestic hot water heating systems, including hot water heaters, storage tanks, control valves, and pressure and temperature relief valves, as required.

1.2 RELATED ITEMS

A. Division 22 Plumbing:
   1. Domestic Water Piping
   2. Gas Piping
   3. Flue Piping
   4. Plumbing Piping Insulation

1.3 CERTIFICATION

A. Provide water heater listed by UL Laboratories, according to ANSZ21.10 Standards governing storage-type water heaters. Must meet ASHRAE/IESNA 90.1-1999 and be design-certified by Underwriter's Laboratories for 180°F water. Must meet SCAQMD Rule 1146.2 for low-nox emissions.

PART 2 - PRODUCTS

2.1 CAPACITY

A. Water heaters shall have the storage capacity and gallons per hour recovery at 100°F rise as scheduled.

2.2 TANK

A. Construct the tank with a 125 psi ASME rating in accordance with the ASME Code, Section IV. Tank shall have a seamless glass-lined steel tank construction.

B. Powered Anodes.

2.3 BURNER

A. A spiral-shaped heat exchanger placed entirely inside the tank which shall be glass-lined on the flue gas side to protect against acidic flue gas condensate.

B. Heater shall have a down-fired power burner designed for precise mixing of air and gas for optimum efficiency, requiring no special calibration on start-up.

2.4 INSULATION

A. Insulate the water heater with factory applied foam insulation and trim with a heavy-gauge, enameled steel jacket.

2.5 CONTROLS

A. Furnish 120V controls for heaters of 100,000 BTUH and above. Controls shall be an integrated solid-state temperature and ignition control device with integral diagnostics, LED fault display capability, and a digital display of temperature system.

2.6 FLUE

A. This water heater(s) shall be suitable for sealed combustion direct-venting with 4" diameter PVC air intake pipe and 4" diameter PVC exhaust pipe for a total of 70 feet of intake and 70 feet of exhaust. Provide a properly sized thermal expansion tank as scheduled on drawings. Refer to manufacturer's installation instructions for material types used in air intake and exhaust pipe use.

2.7 CARBON MONOXIDE MONITORING SYSTEM

A. Provide and install a manual reset Carbon Monoxide Detector located within the boiler room when combustion air is ducted to boilers. The Carbon Monoxide Detector and the boilers shall be interlocked so that the burners will not operate when the level of CO in the room rises above 50ppm. The Carbon Monoxide detector shall disable the boiler's burner upon loss of power to the detector.

B. Carbon Monoxide Sensor with two year warranty by U.S. Draft Co. Model CGM-605 with model XB expansion module.
   1. Provided with pre-programmed dry contacts to shut down equipment during unsafe operation.
   2. NEMA 1 Enclosure
   3. Complies with Texas State Boiler Code 65.603-2015
   4. Additional features shall include 0-10 VDC control signal out, visual alarm and audible alarm.
   5. Provide expansion board for additional equipment interlocks.

2.8 ACCEPTABLE MANUFACTURERS

A. A.O. Smith

B. State

C. Lochinvar

D. Bock

E. Rheem/Ruud

F. PVI

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install a line size valve in the cold water supply close to each heater and a line size plug cock in the gas supply close to each heater.

B. Provide approved dielectric couplings at all cold water and hot water connections to storage tank, and at pressure and temperature relief valve connection.

C. Install according to manufacturer's specifications and pipe as shown.

D. Install water heater in galvanized drain pan piped to floor drain. Provide ¾" outlet connection. Elevate water heater tank bottom above drain pan as to not allow standing water inside of drain pan to touch bottom of tank.

E. Provide and install acid neutralization box for each heater on condensate from exhaust vent.

3.2 STARTUP

A. Startup shall be performed by factory trained and authorized personnel. The factory representative shall also provide a technical and practical operation and maintenance training seminar including a hands-on operation and maintenance demonstration, and classroom presentation with handouts and visual aids, for no less than three physical plant personnel.

B. Startup procedure shall include a functional test of Carbon Monoxide Detector. Simulate an alarm condition and demonstrate the functionality of the detector shutting down the appliances. Owner / Engineer shall be present to witness test.

3.3 WARRANTY

A. Provide standard manufacturer's 1 year commercial warranty for mechanical and electrical and 5 year warranty for leaks. Warranty shall start the date of the substantial completion certificate.

END OF SECTION

SECTION 22 40 00

PLUMBING FIXTURES AND FIXTURE CARRIERS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install water closets, urinals, lavatories, electric drinking fountains, fixture carriers and plumbing appurtenances.

1.2 RELATED WORK

A. Division 22 Plumbing
   1. Drains, Hydrants and Cleanouts.
   2. Domestic Water Piping.
   3. Soil, Waste and Sanitary Drain Piping and Vent Piping.

1.3 JOB REQUIREMENTS

A. Furnish plumbing fixtures and trim as shown and specified. Provide faucets, fittings, supply stops and similar devices of a single manufacturer. Furnish faucets and supply stops with renewable seats. Porcelain to steel and enameled cast iron fixtures shall be acid resistant. Wall hung fixtures shall be installed with a fixture carrier.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Plumbing Fixtures (Vitreous China):
   1. American Standard.
   2. Kohler.
   3. Toto
   4. Zurn
   5. Sloan

B. Plumbing Faucets:
   1. Chicago
   2. T&S Brass (Manual Faucets only)
   3. American Standard
   4. Moen Commercial
   5. Zurn

C. Supports and Carriers:
   1. Josam
   2. Zurn
   3. J.R. Smith.
   4. Wade
   5. Watts

D. Flush Valves:
   1. Sloan “Royal”
   2. Zurn “XL”
   3. Toto “TMT1HNC-32”
   4. Moen Commerical

E. Supplies, Stops and Chrome Plated Tubular Brass:
   1. McGuire
   2. T&S Brass

F. Water Closet Seats:
   1. Beneke
   2. Church
   3. Olsonite
   4. Bemis
   5. Centoco

G. Floor Drains:
   1. Josam
   2. Zurn
   3. J.R. Smith
   4. Wade
   5. Watts

H. Cleanouts:
   1. Josam
   2. Zurn
   3. J.R. Smith
   4. Wade
   5. Watts

I. Stainless Steel Sinks:
   1. Elkay
   2. Moen Commercial

J. Mop Sinks:
   1. Crane Fiat
   2. Stern Williams
   3. Mustee

K. Roof Drains:
   1. Josam
   2. Zurn
   3. J.R. Smith
   4. Wade
   5. Watts

L. Thermostatic Mixing Valves
   1. Symmons
   2. Leonard

M. Emergency Safety Equipment
   1. Bradley
   2. Encon
   3. Chicago

N. Shock Arrestors:
   1. Precision Products

O. Backflow Preventors
   1. Apollo RPLF 4A Series for 2-1/2 inch and larger
   2. Febco

3. Watts

P. Hose Bibbs
1. Wade
2. Chicago
3. Josam
4. Woodford
5. Zurn
6. J.R. Smith

Q. Wall Hydrants
1. Wade
2. Woodford
3. Zurn
4. J.R. Smith
5. Josam

R. Solids Interceptors & Hair/Lint Traps
1. Watts
2. J.R. Smith
3. Zurn

S. Trap Primers
1. Precision Plumbing Products (All Brass construction)

T. Interceptors (Central Outdoor)
1. Park USA
2. Hyrdro-Recycle

U. Shampoo Sink
1. Belvedere

V. Roof Hydrants
1. Mapa Products Model MPH-24-FP:24/9
Note: Roof hydrants with a drain connection are not allowed.

2.2 REQUIREMENTS

A. Refer to the drawings for equipment to be supplied.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the manufacturer's instructions.

B. Make rough-in and final connection of service to each fixture provided under this Section and other Sections or Architectural or Plumbing Drawings.

C. Provide necessary stops, valves, traps, unions, vents, cold water, hot water, sanitary, etc. for a complete installation.

D. Provide isolation valves in domestic water lines to isolate all equipment, restrooms, hose bibbs, and where shown on drawings.

E. Remove piping and services roughed-in incorrectly and install correctly, without cost.

F. Exposed piping, fittings and appurtenances shall be chrome-plated brass.

G. Coordinate with the Contractor for locations and service required for each plumbing fixture.

H. All floor drains and floor sinks shall have trap primer connections. Provide trap primer valves and 1/2-inch water line to each floor drain connection. Trap primer supply line shall have ball valve and Y strainer on inlet side of trap primer valve to facilitate cleaning.

I. All floor drains and floor sink locations are to be coordinated with all equipment. Locate drains in mechanical equipment spaces to conform to drain locations of equipment furnished. Coordinate drain location with food service equipment and Architectural Drawings.

J. All floor drains, floor sinks and cleanout covers are to be provided with stainless steel screws. (No Vandal Resistant Screws)

K. Trap primer valves installed in concealed spaces shall have approved access doors for accessibility.

END OF SECTION

SECTION 22 63 11

GAS PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install steel gas pipe inside buildings, including the supply line from the meter, service lines to gas equipment and appliances, termination of the service line with a plug valve, drip leg, and final connection to equipment and appliances with unions.

B. Coordinate service line from utility main and extend to meter. Coordinate installation of the service line and meter with Gas Company.

C. Extend steel gas piping from meter to inside the building to all fixtures, appliances and equipment requiring gas.

1.2 RELATED WORK

A. Division 22 Plumbing
   1. Plumbing Pipe and Fittings
   2. Valves and Vents

1.3 UTILITY CONNECTIONS

A. Make arrangements for and pay all fees and connection charges for obtaining service to the building.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS - ABOVE GRADE

A. Pipe 2 inch and Smaller:
   1. Schedule 40 ASTM A 53 black steel pipe
   2. Factory fabricated socket weld fittings.

B. Pipe Larger than 2 inch:
   1. Schedule 40 ASTM A 53 black steel pipe.
   2. Factory fabricated butt weld fittings for welded steel pipes shall conform to ASTM A-234 WPB (seamless weld fittings).

C. Unions:
   1. Standard 150 lb. (300 lb. water, oil or gas) malleable iron.
   2. Ground joint unions, with bronze seat.
   3. Flange joints for pipe larger than 2 inch in diameter.

D. Flanges:
   1. Steel flanges. ANSI B16.5 and ASTM A-105.

2.2 PIPE AND FITTINGS - BELOW GRADE OUTSIDE BUILDING

A. Polyethylene pipe shall be ASTM D3350 Grade PE24 cell classification and ASTM D1248 Class B material classification.

B. Pipe shall be medium density polyethylene PE 2406 and PE 2708 manufactured by Poly Pipe Industries, Inc. or Performance Pipe. 1-1/2” to 2” shall be SDR 11 and 3” to 4” shall be SDR 11.5.

C. Polyethylene yellow molded butt fittings for use with medium density polyethylene pipe shall meet testing requirements of ASTM D2513 and resin material listing of ASTM D3350 with PPI designation of PE 2406 as manufactured by Central Plastics Co.

2.3 VALVES

A. See Section 22 05 23.

2.4 GAS PRESSURE REGULATOR

A. Size the gas pressure regulator in accordance with the manufacturer's recommendations for flow quantities and reduced pressure as required for all equipment. Coordinate final equipment gas pressure requirements prior to ordering regulators. Provide American Meter Company regulators or approved equal, suitable for outdoor installation. Regulators outside exposed to weather shall be installed with vent in vertical down position.

B. All line pressure regulators shall be listed in accordance with ANSI (American National Standard) Z21.80 and CSA (Canadian Standards Association Standard) 6.22.

C. Emergency shut off for science classrooms; color: yellow.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation Standards: Install gas piping in accordance with recommendations of the National Fire Protection Association.

B. Drip Legs: Install a capped drip leg 6 inches long at the base of each vertical rise.

C. Coating and Wrapping. Coat and wrap underground piping in accordance with the service utility company standards.

D. Sleeves.
1. Encase gas piping running in or through solid partitions with thin wall metal conduit. Sleeve piping and fittings shall be two pipe sizes, but not less than 1 inch larger than encased gas piping.
2. Encase gas piping running below slab in Schedule 40 PVC, minimum size two pipe sizes larger than gas pipe. Vent sleeve to atmosphere with a 1-1/2 inch vent with 1-1/2 inch return bend above building roof. Seal ends of sleeve with UL fire rated caulk.

E. Do not install gas piping exposed to view inside public area, or occupied spaces, without prior written approval.

F. Weld all gas piping above grade.

G. Provide test ports and isolation valves to enable proper testing of system in the future.

H. Provide isolation valve and unions across regulators for proper removal.

I. Provide transition risers where below grade polyethylene pipe changes to steel pipe above grade.

J. Gas Pressure Regulators / Vents:
1. Piping shall be sized in accordance with the regulator manufacturer's instructions. Never use pipe sizes smaller than the vent size; smaller pipe sizes restrict the gas flow. Where there is more than one regulator at a location, each regulator shall have a separate vent to the roof / outdoors. Headers with various installed devices can cause regulator malfunction.
2. Support the vent pipe to eliminate strain on the regulator diaphragm case.
3. Install vent piping from regulators to location to prevent gas smells from entering building. Do not locate the vent line terminus near windows, fans, or other ventilation equipment. See the installation instructions furnished with the regulator.
4. Install double elbows and insect screen at end of piping to prevent moisture and insects from entering. Always point outdoor vent pipes in the downward position to reduce the possibility of rain, snow, sleet, and other moisture entering the pipe.
5. When installed inside building route vents horizontally and terminate through building sidewall. The vent must be piped to the outside atmosphere using the shortest length of pipe, the fewest possible pipe elbows, and a pipe diameter as large as the vent size or larger. If a long gas run must be used, increase the pipe one nominal size every ten feet to keep the flow restriction as low as possible. Vents terminating through roof must have prior approval from Architect before installation. Through roof penetrations shall be minimized.
6. Regulators installed outside or on roof top: Install regulator vent turned downward with insect screen over vent opening. The vent shall be designed to prevent the entry of water, insects, or other foreign materials that could cause blockage.
7. Ensure the end of the vent line is away from ANY potential ignition sources. It is the installer's responsibility to ensure the vent line is exhausting to a safe environment
8. Adhere to all applicable codes and regulations.

3.2 TESTING GAS PIPING

A. Preliminary gas test as required by Code, but minimum test pressure of 50 PSI held for not less than eight hours without noticeable drop.

B. Test joints with a soap solution while lines are under pressure.

C. Repair leaks.

D. Final gas test shall be with a diaphragm gauge with a minimum dial size of 3-1/2 inches with a set hand and a pressure range not to exceed twenty (20) psig with 2/10-pound increments. The minimum test pressure shall not be less than ten (10) psi and the maximum test pressure shall not exceed twelve (12) psig. This test will be observed for no less than (30) thirty minutes with no drop in pressure. Final gas test must be witnessed by Cy-Fair ISD Plumbing Department personnel.

E. Provide copy of gas pressure test reports in Operations & Maintenance Manual.

F. Provide Railroad Commission of Texas Pipeline Safety Form PS-86B.
1. To find form online, go to: Texas School Gas Test Form

G. School renovations projects shall have all gas piping tested. Report and document gas leaks found to the Architect and Engineer. Repair leaks at no additional cost to the Owner.

H. The District must be notified to witness any gas system test.

I. Send copy of gas piping material and domestic manufacture for approval to Bill Smith and Shannon Thompson at CFISD. Provide test valve opening downstream of main gas shutoff and meter but before building entry with valve to be Nibco T585-70UL (1/4”) with plug cap.

3.3 IDENTIFICATION CONDUCTOR

A. Spiral A #12 AWG insulated copper conductor the full length of the thermoplastic piping system. Fasten to the pipe at 3 foot intervals with plastic tie wraps.

B. Terminate at each end in a 12 inch x 12 inch x 4 inch FRP junction box.
1. Bolted gasketed cover with stainless steel screws.
2. Screw type terminal strip.
3. Legend on cover "gas pipe identification conductor."

C. Set in concrete pad.

3.4 PAINT EXPOSED OUTSIDE GAS PIPE

A. Interior and Exterior Gas piping shall be protected from rust.

B. Paint pipe with a flat alkyd coating, clean pipe prior to painting by preparing surface by hand tool cleaning per SSPC-SP2-82, applying one coat of Glidden Y-590 Rustmaster Metal Primer White and top coat of Yellow Alkyd Flat Enamel.

END OF SECTION

SECTION 23 01 00

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 05 00

MECHANICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of the General Requirements, and other provisions and requirements of the contract documents apply to work of Division 23 Mechanical.

B. Applicable provisions of this section apply to all sections of Division 23, Mechanical.

1.2 CODE REQUIREMENTS AND FEES

A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.

B. Mechanical work shall comply with applicable inspection services:
1. Underwriters Laboratories
2. National Fire Protection Association
3. State Health Department
4. Local Municipal Building Inspection Department
5. Texas Department of Licensing & Regulations (ADA)

C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.

D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.

E. Obtain all permits required.

1.3 CONTRACTOR'S QUALIFICATIONS

A. An approved contractor for the work under this division shall be:
1. A specialist in this field and have the personnel, experience, training, skill, and organization to provide a practical working system
2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that has served their Owners satisfactorily for not less than 3 years

1.4 REFERENCE SPECIFICATIONS AND STANDARDS

A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date bids are received. Requirements in reference specifications and standards are minimum for all equipment, material, and work. In instances where specified capacities, size, or other features of equipment, devices, or materials exceed these minimums, meet specified capacities.

1.5 CONTRACT DRAWINGS

A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

1.6 PROJECT RECORD DOCUMENTS

A. Maintain at the job site a separate set of white prints (black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various lines, valves, ductwork, traps, equipment, and other pertinent items, as installed. Include flow-line elevation of sewer lines. Record existing and new underground and under slab piping with dimensioned locations and elevations of such piping.

B. At the conclusion of project, obtain without cost to the Owner, erasable mylars of the original drawings and transfer as-built changes to these. Prior to transmittal of corrected drawings, obtain 3 sets of blue-line prints of each drawing, regardless of whether corrections were necessary and include in the transmittal (2 sets are for the Owner's use and one set is for the Architect/Engineer's records). Delivery of these as-built prints and reproducibles is a condition of final acceptance. Provide record drawings on one set each (reproducible Dayrex mylar film positives) and AutoCad 2014 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 05 10

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 05 11

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 05 12

SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Prepare submittals as required by these specifications as outlined below.

B. The term submittal, as used herein, refers to all:
1. Shop Drawings
2. Coordination Drawings
3. Product data

C. Submittals shall be prepared and produced for:
1. Distribution as specified
2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.

B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.

C. Identify field dimensions; show relationship to adjacent features, critical features, work, or products.

D. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

1.3 COORDINATION DRAWINGS

A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: ¼” = 1’-0”.

B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation, and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.

C. For each mechanical room and for each outside equipment pad where equipment is located, submit plan and elevation drawings. Show:
1. Actual mechanical equipment and components to be furnished
2. Service clearance
3. Relationship to other equipment and components
4. Roof drains and leader piping
5. Fire protection piping and equipment

D. Identify field dimensions. Show relation to adjacent or critical features of work or products.

E. Related requirements:
   1. Ductwork shop drawings
   2. Coordination drawing specified in Division 26

F. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

G. Gas piping sketch indicating proposed location of piping prior to proceeding with the installation.

1.4 PRODUCT DATA AND INSTALLATION INSTRUCTION

A. Submit only pages which are pertinent to the project. All options which are indicated on the product data shall become part of the contract and shall be required whether specified are not.

B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.

C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.

D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.

E. Mark up a copy of the specifications for the product. Indicate in the margin of each paragraph the following: COMPLY, DO NOT COMPLY, or NOT APPLICABLE. Explain all DO NOT COMPLY statements.

F. Provide a separate transmittal for each submittal item. Transmittals shall indicate product by specification section name and number. Separate all submittals into appropriate specification section number. Do not combine specification sections.

1.5 MANUFACTURERS INSTRUCTIONS

A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up, adjusting, calibrating, balancing and finishing.

1.6 CONTRACTOR RESPONSIBILITIES

A. Review submittals prior to transmittal.

B. Determine and verify:
   1. Field measurements
   2. Field construction criteria
   3. Manufacturer's catalog numbers
   4. Conformance with requirements of Contract Documents

C. Coordinate submittals with requirements of the work and of the Contract Documents.

D. Notify the Architect/Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.

E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect / Engineer's acceptance.

F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect / Engineer reviews submittals or not.

G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect/Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations on reviewed documents.

H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
   1. Proper sizes and capacities
   2. That the item will fit in the available space in a manner that will allow proper service
   3. Construction methods, materials and finishes

I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

1.7 SUBMISSION REQUIREMENTS

A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.

B. Number of submittals required:
   1. Shop Drawings and Coordination Drawings: Submit one reproducible transparency and three opaque reproductions.
   2. Product Data: Submit the number of copies which the contractor requires, plus those which will be retained by the Architect/Engineer.

C. Accompany submittals with transmittal letter, in duplicate, containing:
   1. Date
   2. Project title and number
   3. Contractor's name, address and contact number.
   4. The number of each Shop Drawing, Project Datum and Sample submitted
   5. Other pertinent data

D. Submittals shall include:
   1. The date of submission
   2. The project title and number
   3. Contract Identification
   4. The names of:
      a. Contractor
      b. Subcontractor
      c. Supplier
      d. Manufacturer
   5. Identification of the product
   6. Field dimensions, clearly identified as such
   7. Relation to adjacent or critical features of the work or materials
   8. Applicable standards, such as ASTM or federal specifications numbers
   9. Identification of deviations from contract documents

10. Suitable blank space for General Contractor and Architect/Engineer stamps
11. Contractor's signed and dated Stamp of Approval

E. Coordinate submittals into logical groupings to facilitate interrelation of the several items:
   1. Finishes which involve Architect/Engineer selection of colors, textures or patterns
   2. Associated items which require correlation for efficient function or for installation

1.8 SUBMITTAL SPECIFICATION INFORMATION

A. Every submittal document shall bear the following information as used in the project manual:
   1. The related specification section number
   2. The exact specification section title

B. Submittals delivered to the Architect/Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.9 RESUBMISSION REQUIREMENTS

A. Make re-submittals under procedures specified for initial submittals.
   1. Indicate that the document or sample is a re-submittal
   2. Identify changes made since previous submittals

B. Indicate any changes which have been made, other than those requested by the Architect / Engineer.

1.10 CONTRACTOR'S STAMP OF APPROVAL

A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.

B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect/Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.

C. Do not deliver any submittals to the Architect/Engineer that do not bear the Contractor's stamp of approval and signature.

D. Submittals delivered to the Architect/Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.11 ARCHITECT / ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

A. The Architect / Engineer will:
   1. Review identified submittals with reasonable promptness and in accordance with schedule

2. Affix stamp and initials or signature, and indicate requirements for re-submittal or approval of submittal
3. Return submittals to Contractor for distribution or for resubmission

B. Review and approval of submittals will not extend to design data reflected in submittals which is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.

C. Architect / Engineer's review and approval is only for conformance with the design concept of the project and for compliance with the information given in the contract.
1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.

D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

1.12 SUBSTITUTIONS

A. Do not make requests for substitution employing the procedures of this Section.

B. The procedure for making a formal request for substitution is specified in Div. 1.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 23 05 13

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 05 14

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 05 17

HVAC ACCESS DOORS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install access doors in wall or ceiling locations as required or shown for access to valves, controls, fire dampers, air distribution devices and other equipment requiring maintenance, adjustment or operation.

PART 2 - PRODUCTS

2.1 NON-FIRE RATED ACCESS DOORS

A. 16-Gauge frames

B. 14-gauge steel panels

C. Continuous fully concealed hinges

D. Flush screwdriver cam lock & cylinder lock for Owner selection

E. Automatic closing and latching mechanism

F. Prime coat finish

G. Brushed satin stainless steel finish for restroom, kitchen or cafeteria installation

H. Material suitable for wall and/or ceiling mounting

2.2 FIRE RATED ACCESS DOORS

A. UL listed, 1-1/2 hour Label “B”, access doors

B. 16-Gauge stainless steel

C. 20-Gauge insulated sandwich-type door panel.

D. Two inch thick with fire rated insulation

E. Continuous fully concealed hinge

F. Automatic closing and latching mechanism

G. Knurled knob and recessed key operation for Owner selection

H. Interior latch release slide for opening from inside

I. Prime coat finish

J. Material suitable for wall and/or ceiling mounting

2.3 ACCEPTABLE MANUFACTURERS

A. Milcor

B. MIFAB

C. Acudor

D. Elmdor

PART 3 - EXECUTION

3.1 INSTALLATION

A. Access doors specified in Division 23 will be installed by other crafts. Not all required access doors are shown. Coordinate with the Contractor to locate access doors for ease of operation and maintenance of concealed equipment.

B. Installation shall be in accordance with the manufacturer's printed instructions.

C. Minimum size required:
   1. 36" x 24" for Mechanical HVAC equipment related items
   2. 18" x 18" for electrical related items
   3. 12" x 12" minimum for Fire and Smoke dampers

END OF SECTION

SECTION 23 05 18

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 inventor.
   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 of immediately before displayed tripped.

    Any drive requiring separate card to provide this information shall provide a diagnostic card for each drive.
28. DC link reactor.
29. Input power disconnect, lockable type.
30. Input power disconnect switch / circuit breaker, with lockable type handle.

2.5 OPERATOR DEVICES

A. The following operator devices shall be door or remote mounted:
   1. Digital keypad and LCD provided to perform all parameter adjustments, operation monitoring, and operation programming.
   2. Power on indication light.
   3. Flush mounted meters or digital display to indicate output voltage, output frequency, and output current, in percent of maximum 0 to 100%.
   4. Manual/Off/Auto 3 position selector switch (hand-off-auto) and manual speed setting control to provide the following control sequences:
      a. In automatic mode, controller shall follow an external control signal and respond to remote start-stop contact.
      b. In manual (hand) mode, controller shall follow speed signal set via door mounted keypad and start/stop switch. Switching from “hand” to “auto” and vice versa shall require a single keystroke to a dedicated changeover key. Inverters requiring multiple keystrokes and/or

reprogramming of internal parameters to accomplish changeovers are not acceptable.

c. An integral "safety interlock" protection shutdown circuit shall be provided for interface with firestats, smoke detectors, high static pressure limit switches, vibration switches, etc.

5. Programmable lockout code to prevent unauthorized programming.
6. Critical frequency avoidance capability (up to 3 resonant points).

2.6 FIELD ADJUSTMENTS

A. The following shall be adjustable in the field:
1. Maximum Speed: 0 to 125% adjustable.
2. Minimum Speed: 0 to 100% adjustable.
3. Acceleration/deceleration rates: 0 to 3600 sec.
4. Instantaneous overcurrent trip: 50% to 2000%.
5. Volts/hertz ratio: Field adjustable to 16 patterns or set for automatic selection of proper V/F load profile to operate motor without overdriving or overloading.
6. Current limit circuit: 60 to 100%.
7. Carrier frequency: 6 to 16 KHZ.
8. Control interface: selectable to follow a 0-5 VDC, 0-10 VDC, 4-20 MA, either direct or indirect acting.
9. Control signal Bias: 0 to 80 HZ.
10. Control signal gain: 0 to 80 HZ.
11. Calibration of remote speed signal: 0 to 80 HZ.

2.7 ELECTRICAL CONSTANT SPEED BYPASS

A. Provide all components and circuitry necessary to provide manual bypass of the inverter. The bypass package shall be mounted in a cabinet common with the inverter and shall be constructed in such a manner that the inverter can be removed for repair while still operating the motor in the "bypass" mode. Manual bypass shall contain the following:
1. Two contactors mechanically interlocked via a three position through the door selector switch to provide the following control:
a. "Inverter" Mode connects the motor to the output of the inverter.
b. "Bypass" Mode connects the motor to the input sine wave power. Transfer must occur with input disconnect open. Motor is protected via thermal overload.
c. "Off" Mode disconnects motor from all input power.
2. A molded case circuit breaker or fused disconnect switch with door interlocked handle (lock out type) that interrupts input power to both the bypass circuitry and the drive.
3. An input contactor, interlocked with both the thermal motor overload and external safeties which disconnects power to the motor regardless of the mode of operation (either "inverter" or "bypass" mode).
4. A thermal overload to provide protection of motor in the bypass mode.
5. A safety interlock circuit that disconnects power to the motor (regardless of the mode of operation – “inverter” or “bypass”) in response to a signal from the thermal overload and/or external safety circuits.
6. Line voltage to 24 volt DC power source, fused per NEC, shall provide power to all bypass control circuits.

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 05 19

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 05 23

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 Duochek
      b. Nibco
      c. Keystone
      d. Milwaukee Valve
      e. Keckley

K. Provide valves of same manufacturer throughout where possible.

L. Provide valves with manufacturer's name and manufacturing location, duty and pressure rating clearly marked on outside of body.

M. Where valves are installed in insulated piping, provide with extended neck so valve

operator and stop plate clears the full thickness insulation.

N. Provide valve, seat and trim materials suitable for the intended service.

O. 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 05 33

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 05 48

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 (400m) 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/mm5) 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.

2.3 ISOLATOR APPLICATION

EQUIPMENT	ISOLATOR TYPE	MINIMUM DEFLECTION
Chiller	A	0.35”
Condensing Units	A	0.35”
Suspended Fan Coil Units	B	0.5”
In-Line Fans	B	0.5”

2.4 PIPING ISOLATOR APPLICATIONS

EQUIPMENT	ISOLATOR TYPE
Floor Mounted Pumps	C
Suspended Pumps	C
Chiller Pipe Connections	C

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 05 93

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 fiv 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 05 94

COORDINATION OF TESTING AND BALANCING

PART 1 - TESTING, BALANCING AND ADJUSTING

1.1 WORK INCLUDED

A. Balancing and adjusting of the environmental systems is specified in Section 23 05 93.

B. Coordination of the work is specified in this Section.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 COORDINATION

A. Bring the work to a state of readiness for testing, balancing, and adjusting.
   1. Install air terminal devices.
   2. Provide specified filters in air handling equipment. Install clean filters just prior to the start of the test and balance work.
   3. Verify lubrication of equipment.
   4. Install permanent instrumentation.
   5. Clean piping systems and fill with clean water.
   6. Complete "Start-up" of equipment.
   7. Check rotation and alignment of rotating equipment and tension of belted drives.
   8. Verify ratings of overload heaters in motor starters.
   9. Verify that safety and operating control set points are as designed and automatic control sequences have been checked.
   10. Provide control diagrams and sequence of operation.
   11. Collect material for maintenance manuals and prepare one manual especially for use in testing and balancing.
   12. Verify that graphic operational data such as start/stop instructions, valve tag schedules, and piping identification schedules have been provided where needed.
   13. Verify that equipment and piping identification work has been completed with valve tags, schedules, and piping identification system.
   14. Comb out fins on extended-surface heat transfer coils where damaged.
   15. Clean all strainers as required.
   16. Remove construction strainers after water is cleaned and treated.
   17. Remove all temporary filters from HVAC equipment.
   18. Provide start-up reports listing all start-up information and manufacturer’s information attached.

B. Provide and install new pulleys and belts as required to effect the correct speed ratio. Adjustments where no belt or pulley change is required, is specified in Section 23 05 93.

C. Verify that the systems are ready for balancing and adjusting.

D. Submit a letter stating:
   1. The specified pieces of equipment have been checked, started, and adjusted

by the manufacturer.
2. Other equipment has been checked and started.
3. The systems have been operated for the specified period of time.
4. The automatic controls system has been adjusted, calibrated, and checked, and is operating as specified.

E. Provide the services of a technician full time at all times at the project when testing, balancing and adjusting work is being conducted.

F. Provide instrumentation and services to take readings of the required data for the refrigerant circuits.

G. Provide and install volume dampers required for balancing by the TAB Contractor.

3.2 START-UP OF EQUIPMENT

A. Pre-start & Start-up equipment using the procedures as recommended by the manufacturers.

B. Complete start-up of equipment prior to start of testing & balancing.

C. Submit start-up procedures as outlined by the manufacturers and complete the "HVAC FAN / AIR HANDLING / START-UP REPORT FORM" to Engineer.

HVAC FAN / AIR HANDLING UNIT / START-UP REPORT FORM														
Equipment Description	Actual			Disc. Switch Wired	Rotation Correct	Belt		RPM Correct Submittal	Vibration Isolation Correct	Attachment To Roof Curb	List Of Damage Parts	Bearings Lubricated	Filter Installed	Interlocks & Dampers Operational
	Voltage	Amps	HP			Condition & Part #	Tension Correct							

END OF SECTION

SECTION 23 07 13

EXTERNAL DUCT INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install external insulation on supply, return, exhaust and outside air ductwork.

B. External insulation of concealed and exposed ducts is included in this Section. Internal acoustic duct lining is specified under ductwork and not included in this Section.

1.2 RELATED WORK

A. Division 9 - FINISHES. Painting and Color Coding.

B. Division 23 - MECHANICAL.
1. Air Handling Units. Internal insulation for air units is specified in the sections on air handling units. The units do not require external insulation.
2. Internal Duct Liner. Internal duct liner is specified in the section on ductwork.
3. Insulation. Refer to specific sections on individual insulation types.
4. Refer to insulation and liner plan detail.

1.3 QUALITY ASSURANCE

A. The intent of insulation specifications is to obtain superior quality workmanship, resulting in an installation that is absolutely satisfactory in both function and appearance. Provide insulation in accordance with the specifications for each type of service and apply as recommended by the manufacturer and as specified.

B. An approved contractor for this work under this Division shall be:
1. A specialist in this field and have the personnel, experience, training, skill, and the organization to provide a practical working system.
2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that have served their Owners satisfactorily for not less than 3 years.

C. All duct insulation used on the project inside the building must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50 as determined by test procedures ASTM E84, NFPA 255 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements and bear the UL label.

D. Condensation on any insulated system is not approved.

E. Replace insulation damaged by either moisture or other means. Insulation that has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation. Also repair any damage caused by the condensation.

F. Where existing insulated ductwork or other services are tapped, remove existing

insulation back to undamaged sections and replace with new insulation of the same type and thickness as existing insulation. Apply as specified for insulation of the same service.

1.4 APPROVALS

A. Submittals. Submit product data on each insulation type, adhesive, and finish to be used in the work. Make the submittal as specified in Division 1 General Requirements and obtain approval before beginning installation. Include product description, list of materials and thickness for each service and location, and the manufacturer's installation instructions for each product.

B. Sample Application. Make an application of each type of insulation to display the material, quality and application method. Obtain approval of the sample application before proceeding with installation of the work.

PART 2 - PRODUCTS

2.1 INSULATION

A. Glass fiber rigid duct insulation.
   1. Minimum density of 3 pcf, installed R value to be 6.0 (when located in a conditioned plenum) and 8.0 (when located in an unconditioned plenum) at 75°F mean, facing of 0.7 mil aluminum foil reinforced with glass yarn mesh and laminated to 40 lbs. fire-resistant Kraft. R-value to be indicated on exterior side of insulation to be verified by City inspector.
   2. Acceptable Manufacturers
      a. Schuller 814 spin-glas FSK.
      b. Owens-Corning Type 703 board RKF.
      c. Knauf 3 PCF FSK.

B. Glass fiber blanket duct insulation.
   1. Minimum density of 1.0 pcf, installed R value to be 6.0 (when located in a conditioned plenum) and 8.0 (when located in an unconditioned plenum) at 75°F mean, facing of 0.35 mil foil reinforced with glass yarn mesh and laminated to 40 lbs. fire resistant Kraft. R-value to be indicated on exterior side of insulation to be verified by City inspector.
   2. Acceptable Manufacturers
      a. Manville R-series Microlite FSKL.
      b. Owens-Corning ED100 RKF.
      c. Knauf 1.0 PCF FSK.

C. Fiberglass reinforcing cloth mesh.
   1. Acceptable Manufacturers
      a. Perma Glass Mesh.
      b. Alpha Glass Mesh.
      c. Childers Chil-Glas #10
      d. Foster Mast a Fab
      e. Vimasco.

D. Mastics, sealants, coatings and adhesives.
   1. Acceptable Manufacturers
      a. Childers.
      B. Foster.
      c. Vimasco.

E. Fireboard Insulation
1. Totally encapsulated with foil facing.
2. Two hour rated fire protection.
3. Zero clearance to combustible protection.
4. System shall be listed and labeled by an NRTL.
5. Tested per ISO 6944, Type A Duct and achieve a 2 hour rating for stability, integrity and insulation.
6. Provided system is subject to the approval of the Local Authority Having Jurisdiction.
7. Acceptable Manufacturers
   a. Unifrax ON Fyrewrap Elite 1.5
   b. Partak Insulation, Inc. Paroc Fireboard
   c. Thermal Ceramics FireMaster 3M
   d. Premier Refractories International, Pyroscat.

F. Rigid Closed Cell Insulation
1. Acceptable Manufacturers
   a. Dow Trymer.
   b. Phenolic Foam.

G. Reinforced Foil Tape
1. Acceptable Manufacturers
   a. Venture 1525CW
   b. 3” FSK
2. Thickness 6.5 mils
3. Color: silver

2.2 COATING AND ADHESIVE

A. Coating. Provide Childers CP-38 or Foster 30-80 vapor barrier coating. Coating must meet MIL Spec C-19565C, Type II and be QPL Listed. Permeance shall be 0.013 perms or less at 43 mils dry. Tested at 100ºF and 90% RH per ASTM E96.

B. Outdoors: Provide as insulation coating Childers Encacel X or Foster Monolar 60-90. Permeance shall be 0.03 perms or less at 30 mils dry. Tested at 100ºF and 90% RH per ASTM F 1249.

C. Adhesive. Provide Childers CP-82 or Foster 85-20 vapor barrier adhesive.

D. Reinforcing Mesh. Provide 10 x 10 white glass or polyester reinforcing mesh.

2.3 OUTDOOR DUCT LAMINATED JACKETING

A. Rubberized bitumen compound material:
1. Ultraviolet resistant
2. Weatherproof
3. Vapor retarding jacketing
4. Laminated jacketing
5. Cross-laminated high strength polyethylene film
6. Laminated to aluminum foil
7. Minimum 60-mil thickness

B. Acceptable Manufacturers:
1. Alumaguard 60

2. Flex Clad 400
3. Venture Clad 1577CW

PART 3 - EXECUTION

3.1 FIRE SAFETY REQUIREMENTS

A. Do not extend duct coverings through walls or floors required to be fire-stopped or required to have a fire resistance rating. Interrupt duct coverings in the immediate vicinity of heat sources such as electric resistance or fuel-burning heater.

3.2 CONCEALED DUCT

A. Provide flexible glass fiber insulation with factory-applied, reinforced UL labeled Foil-Skrim-Kraft (FSK) facing.

B. Standing Seams. Insulate standing seams and stiffeners, which protrude through the insulation with 0.6 lb. per cubic foot density, 1-1/2” thick, faced, flexible blanket insulation. Insulation shall not prevent adjustment of damper operators.

C. Insulation shall be wrapped tightly on the ductwork with all circumferential joints butted and longitudinal joints overlapped a minimum of 2”. In addition, secure insulation to the bottom of rectangular ductwork by the use of either weld pins with washers or cup-head pins welded to the ductwork or perforated based insulation hangers glued to the duct on twelve inch centers to prevent sagging of insulation.

D. On circumferential joint, the 2” flange on the facing shall be stapled with 9/16” outward clinch steel staples on 2” centers and taped using 3” wide foil tape applied with additional adhesive of Foster 85-75. Cover all seams, joints, pin penetrations and other breaks with foil tape and glue.

E. Ductwork in mechanical rooms is considered concealed spaces.

3.3 EXPOSED DUCT INSULATION

A. Ductwork in exposed locations is to be insulated with fiberglass rigid / semi-rigid board insulation.
1. Apply fabric and mastic to provide a smooth surface for painting.

B. Standing Seams: Insulate standing seams and stiffeners which protrude through the insulation with 0.6 lb per cubic foot density, 1-1/2 inch thick, faced insulation. As a vapor seal, use reinforcing mesh with vapor barrier coating. Insulation shall not prevent adjustment of damper operators.

C. Insulation shall be wrapped tightly on the ductwork. Adhere insulation to ductwork with adhesive. In addition, secure insulation to the bottom of rectangular ductwork by the use of either weld pins with washers or cup-head pins welded to the ductwork or perforated based insulation hangers glued to the duct on 12 inch centers to prevent sagging of insulation.

D. Cover all seams, joints, pin penetrations and other breaks with coating reinforced with reinforcing mesh. Fabric shall not be visible after coating.

3.4 OUTDOOR DUCTWORK COVERING

A. Cover all supply and return ductwork outdoors:
   1. 1-1/2” thick, rigid closed cell insulation with reinforced foil facing.

B. Install a high point in center and slope in both directions so water will not stand on horizontal surfaces.

C. Impale the insulation over mechanical fasteners and washers.
   1. A minimum of 2 rows of fasteners per side on 12-inch centers.
   2. Seal all breaks, joints and punctures by applying a 1/8” thick vapor barrier mastic coating, embedded in open mesh reinforcing mesh.

D. Standing S, or flanged connections shall be covered with the same thickness of insulation overlapped a minimum of 4”.

E. Apply a tack coat of Childers CP-10/11 or Foster 46-50 weather barrier mastic over the entire surface.
   1. While this coat is still tacky, Childers #5 glass fiber reinforcing mesh shall be smoothly applied and pressed into the mastic. The cloth shall be taut with adjacent edges overlapped a minimum of 4”.
   2. After the first coat of mastic has taken its set, the second coat shall be applied over the cloth by palm, trowel, or spray to sufficient thickness that, when dried, the combined thickness of mastic and cloth is not less than 1/8”.
   3. Upon completion, the openings in the cloth shall be completely sealed and the yarn shall not be visible. The completed work shall be completely smooth and present a plane surface.
   4. Aluminum gray or white finish as approved by the Architect.

F. Standing water on horizontal surfaces is not approved.

G. Apply outdoor duct laminated jacketing protection over entire insulation surface. Apply rubberized bitumen compound, applied to a cross-laminated high strength polyethylene film, laminated to aluminum foil.

3.5 KITCHEN GREASE EXHAUST DUCTWORK / KILN DUCTWORK / FUME HOOD DUCT

A. Secure fireboard insulation to duct with impaling pins and 3” square speed clips. In addition, provide a wire mesh support system and additional sealing or support as required by the code enforcing authority. The insulation support system shall include framed access to allow the insulation to be removed and replaced without damage at the access doors in the duct system for inspection and cleaning. Coordinate location of access openings to correspond accurately. Provide stainless steel banding on 12” centers.

3.6 GENERAL INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Apply insulation on clean, dry surfaces only.

C. Continue insulation with vapor barrier through penetrations.

D. Neatly finish insulation at supports, protrusions and interruptions.

E. Install insulation on clean, dry surfaces, and only after building is weatherproofed sufficiently to preclude any rainwater on insulation.

F. Apply mastic over the fiberglass reinforcing mesh to a thickness where fabric is not visible after completion.

G. Install fiberglass blanket duct insulation on top of supply air grilles not fire rated.

END OF SECTION

SECTION 23 07 16

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 07 19

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 ¾" shall have a flame spread rating of 25 or less and a smoke developed rating of 100 or less when tested in accordance with ASTM E84, latest revision. In addition, the product, when tested, shall not melt or drip flaming particles, and the flame shall not be progressive. In addition, all materials shall pass simulated end-use fire test.
   1. Thermal conductivity 0.27 at 75°F mean (ASTM C177 or C518)

2.5 CELLULAR GLASS INSULATION

A. ASTM C552:
   1. "k" value of 0.35 @ 75°F ("ksi" value of 0.047 @ 24°C);
   2. 8.0 lb/cu.ft. (128 kg/cu.m.) density

2.6 INSULATION/SHIELD AT HANGERS

A. Field fabricated: Use 360° sections of rigid foamglass insulation that will support the bearing area at hangers and supports. Further support insulation at hangers and supports with a shield of galvanized metal covering at least half of the pipe circumference, and conforming to the schedule. Insulation shall extend at least 1" beyond metal shield on each end. When pipe is guided at top and bottom, metal shields shall cover the whole pipe circumference. Adhere metal shield to insulation so that metal will not slide with respect to insulation with ½" aluminum bands (2) per shield.
   1. Sections of foam glass insulation may be used of the same outside diameter of the adjoining pipe insulation.
   2. Minimum thickness of foam glass insulation shall not be less than 1" thick.

B. Pipe saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter or more than 22". Provide 18 gauge through 4" pipe and 16-gauge 5" pipe and above.

2.7 SEALANT, ADHESIVE AND FINISH

A. Lap Adhesive. Provide Childers CP-82 or Foster 85-20 adhesive.

B. Vapor Barrier Finish:
   1. Indoors: Provide as insulation coating Childers CP-38 or Foster 30-80, white. Coating must meet MIL Spec C-19565C, Type II and be QPL Listed. Permeance shall be 0.013 perms or less at 43 mils dry. Tested at 100ºF and 90% RH per ASTM E96.
   2. Outdoors: Provide as insulation coating Childers Encacel X or Foster 60-90. Permeance shall be 0.03 perms or less at 30 mils dry. Tested at 100ºF and 90% RH per ASTM F 1249 and must be Hypalon rubber based.
   3. Underground: Provide Childers CP-22/24 or Foster 60-25/26 for fittings and areas. Pittwrap cannot be used.

C. Insulation Joint Sealant. Provide Childers CP-76 or Foster 95-50 vapor barrier sealant.

D. Metal Jacketing Sealant. Provide Childers CP-76 or Foster 95-44 metal jacketing sealant for all outdoor metal jacketing laps.

E. Lagging Adhesive. Provide Childers CP-50AMV1 or Foster 30-36.

F. Other products of equal quality will be acceptable only upon approval.

2.8 ALUMINUM JACKETING

A. Finish insulated piping outdoors with a smooth prefabricated Z-lock aluminum jacket 0.016” thick with factory applied 1 mil polyethylene/40 lb and Fab strap. Kraft moisture barrier.

B. Valves, Fittings and Flanges. For finishing valves, fittings, flanges and similar installations, provide formed aluminum covers, 0.024” thick.

C. Straps and Seals. Provide ½” x 0.020 stainless steel strapping and seals for jackets and covers according to manufacturer's recommendations.

2.9 GLASS FIBER BLANKET INSULATION

A. Minimum density of 1.0 PCF, 2” thick, installed R value to be 6.0 or better at 75°F mean, facing of 0.35 mil foil reinforced with glass yarn mesh and laminated to 40 lbs fire resistant kraft.

PART 3 - EXECUTION

3.1 INTERIOR PIPING

A. Cover all hot water piping with glass fiber, heavy density, dual temperature pipe insulation with a vapor barrier jacket. Apply insulation to clean, dry pipes. Longitudinal seams shall be joined firmly together and sealed with self-sealing lap joints. Butt insulation joints firmly together and seal with a 3” wide ASJ butt strip seal. Longitudinal seams and butt strip laps shall be coated and sealed with CP-35 vapor barrier coating for chilled water piping applications.

B. Cover all chilled water piping with rigid foam insulation.
   1. Adhere the vapor barrier jacket longitudinal seam with vapor barrier adhesive.
   2. Cover all valves, fittings and flanges with factory made molded or field fabricated segments of pipe insulation of a thickness and material equal to the adjoining insulation. Adhere segments together with no voids, using CP-82 adhesive. Secure fitting insulation covers and segments in place with ½" wide glass filament tape.
   3. Apply a tack coat of fitting mastic over the insulation and tape.
   4. Neatly embed with 10 x 10 fiberglass cloth into the tack coat.
   5. Apply mastic over the fiberglass cloth to a thickness where the fabric is not visible after completion.
   6. Seal ends of pipe insulation with vapor barrier mastic at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the foam, down onto the pipe, making a complete seal.

C. Install hanger with protective shield, on the outside of all insulation.

D. Pipe Saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter. Provide 18-gauge through 4" pipe and 16-gauge for 5" pipe and above.

E. Seal ends of pipe for chilled water insulation with vapor barrier mastic at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the glass, down onto the pipe making a complete seal.

F. Apply a smooth flood coat of white lagging Foster 8142W over all exposed insulation.

G. Piping to be insulated as specified above:
   1. Chilled water and heating water
   2. Make-up water

3.2 REFRIGERANT AND CONDENSATE PIPING

A. Cover all pipe with elastomeric insulation by slitting tubular sections or sliding unslit sections over the open ends of piping or tubing. Seams and butt joints shall be adhered and sealed using Foster 85-75, Childers CP-82 or Armstrong 520 Adhesive.

B. All fittings shall be insulated with the same insulation thickness as the adjacent piping. All seams and mitered joints shall be adhered with Foster 85-75, Childers CP-82 or 520 Adhesive.

C. Pipe Saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter.

D. Outdoor exposed piping shall be painted with two coats of either WB or SB Armaflex finish or Foster 30-64 elastomer foam coating. All seams shall be located on the lower half of the pipe.

3.3 PIPING OUTDOORS ABOVE GRADE

A. Insulate all 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 100ºF 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

INSULATED UNIT	THICKNESS (Inches)
Refrigerant Piping	1-1/2
Chilled Water Piping (through 2” pipe)	1-1/2
Chilled Water Piping (2-1/2” pipe and Larger)	2
Condensate Drains	1
Heating Water Piping 2” Pipe and Larger	2
Heating Water Piping 1-1/2” Pipe and Smaller	1-1/2
Exterior Chilled and Hot Water Piping, 5” Pipe and Larger	2
Exterior Chilled and Hot Water Piping 4” Pipe and Smaller	1-1/2

END OF SECTION

SECTION 23 08 00

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 09 33

BUILDING MANAGEMENT AND CONTROL SYSTEM

PART 1 – GENERAL

1.1 SCOPE

A. **Cy Falls High School** – The existing campus is controlled by a Reliable Control system installed by Unify 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 competition of this projects 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.

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. Unify Energy Solutions – Reliable Controls

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 affective 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)
   a. Line Size Valve
   b. Under-cut disk for smooth operation
   c. Full Lug Valve
   d. Cast Iron Body
   e. EPDM – Molded-in 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 operating 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%.

2.16 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

2.17 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

2.18 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. 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.

2.19 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.

2.20 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

2.21 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.

2.22 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.

2.23 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.

2.24 HIGH STATIC PRESSURE SWITCH

A. With manual reset switch
1. Approved manufacturer: Cleveland AFS-460.

2.25 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

2.26 CONTROL DAMPERS

A. Opposed blade dampers:
1. Frames of 13-gauge galvanized sheet metal.
2. Provisions for duct mounting.
3. Damper blades not exceeding 8" in width.
4. Blades of two sheets of 16-gauge galvanized sheet metal.
5. Blades suitable for high velocity performance.
6. Bearings of nylon or oil-impregnated, sinthered bronze.
7. Shafts of 1/2" zinc plated steel
8. Leakage does not exceed 1/2% based on 2000 fpm and 4" static pressure.
9. Replaceable resilient seals along top, bottom and sides of frame and blade edge.
10. Submit leakage and flow characteristics data with shop drawings.

11. Linkage shall be concealed out of the air stream within damper frame.
12. Acceptable Model is Ruskin Model CD60.

2.27 PHOTOCELL CONTROL

A. Light Sensitive Resistor:
1. 4-20 output or switch
2. On = 3.0 / fc. Off 10.0 / fc
3. UL Approved

2.28 DRAIN PAN FLOAT SWITCH

A. Rated at 10 Amps:
1. Shuts off equipment if water level becomes too high.
2. DPDT Contacts.

2.29 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

2.30 TEMPERATURE/CO_2 SENSOR

A. Sensor combo in one housing, Temperature and CO2.

B. Provide combo temperature/CO2 sensor in the following locations:

1. Each Classroom
2 Library
3. Cafeteria
4. 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:
1. Corridors
2. Cafeteria
3. Kitchen.
4. Gymnasium.
5. Dressing Rooms.
6. Industrial Labs.

J. Color to be approved by Architect / Owner, submit sample for review.

2.31 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

2.32 HVAC SHUTDOWN STATION

A. Shutdown Switch:
   1. Yellow Mushroom Button within a clear plastic cover
   2. Latches when depressed
   3. Twist reset
   4. Sign “HVAC SHUTDOWN”
   5. Manufactured by STI Model # SS2231HV-EN

2.33 CARBON MONOXIDE MONITORING SYSTEM

A. Provide and install a manual reset Carbon Monoxide Detector located within the boiler room. The Carbon Monoxide Detector and the boilers shall be interlocked so that the burners will not operate when the level of CO in the room rises above 50ppm. The Carbon Monoxide detector shall disable the boiler’s burner upon loss of power to the detector.

B. Carbon Monoxide Sensor with two-year warranty by U.S. Draft Co. Model CGM-605 with model XB expansion module or Greystone Model CMD5B series.

   1. Provided with pre-programmed dry contacts to shut down equipment during unsafe operation.
   2. NEMA 1 Enclosure
   3. Complies with Texas State Boiler Code 65.603-2015
   4. Additional features shall include 0-10 VDC control signal out, visual alarm and audible alarm.
   5. Provide expansion board for additional equipment interlocks.

2.16 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 filtometer
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 4-20mAmp 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. Strobes 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 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.

3.2 INTERLOCK AND SAFETY CIRCUITS

A. Close the outdoor air dampers when the related HVAC unit supply or exhaust fan is de-energized:
   1. The damper and actuators are specified in this section.
   2. Outdoor air damper shall be fully opened before related air handling unit fan is energized for 100% outside air use.
   3. Provide motorized outside air dampers for the following:
      a. Supply fans
      b. AHUs
      c. Exhaust fans (except kitchen exhaust)
      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, oil level switch and oil pump 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. Emergency Shutdown Station:
1. Provide an emergency mushroom style push / pull station shutdown switch in the 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.

J. Condensing Hot Water Boilers:
1. Interlock each boiler to start its dedicated pump.
2. Install communication cable between each boiler and master controller specified by boiler manufacturer.

3.3 GRAPHICS

A. Furnish as-built drawings indicating 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.
8. 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.

3.4 IDENTIFICATION

A. Provide a laminated engraved nameplate on all control panels and devices shown on the "as installed" control diagrams. Coordinate engraving with nomenclature used on the diagrams.

B. A black-white-black laminated plastic engraved identifying nameplate shall be secured to each terminal cabinet, and control panels. Identifying nameplates shall have ½ inch high, engraved letters.

C. 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.”

3.5 WIRING FOR BUILDING MANAGEMENT AND CONTROL SYSTEMS

A. Furnish and install all wire, conduit, raceways and cable systems required for the complete operation of the Building Management and Control System.

B. All wiring for the Building Management and Control System is specified in this section and includes, but is not limited to:
1. Wiring of interlock system.
2. Wiring of control instruments.
3. Wiring of control panels.
4. Wiring of related power supplies, i.e. transformers.
5. Wiring of 120 VAC power circuits for control panels and devices.

C. All materials and methods specified in this section shall comply with the requirements specified in Division 26 of this specification.

D. All power supply requirements shall be connected to the building electrical distribution system in an approved manner. Do not connect control equipment of circuits common with other building loads or devices.

E. Temperature control wiring shall be jacketed cables installed with or without conduit as specified below or single conductors installed in conduit. Control wiring shall have minimum 300V insulation for low voltage wiring and 600V insulation for line voltage wiring.

F. All line voltage control wiring, all low voltage control wiring which is exposed in the central plant, penthouse, and other 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

3.6 EXHAUST AND SUPPLY FANS

A. Where new fans are being provided, provide all points and interlocks as indicated below and scheduled on the plans unless shown on the electrical drawings.

B. Where existing fans are being replaced, provide all points and interlocks as indicated below and scheduled on the plans unless shown on the electrical drawings.

C. Provide BMCS override to disable operation of all exhaust and supply fans interlocked and/or specified throughout project.

D. 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) Air Flow Sensing Switch (SF)
Exhaust Air Damper	DO	Electronic Operator

3.7 MISCELLANEOUS

A. MDF/IDF Temperature Sensor: Provide a temperature sensor in each MDF and IDF rooms to monitor space conditions. BMCS shall alarm when temperature is out of setpoint range.

POINT DESCRIPTION	TYPE	DEVICE
MDF/IDF Temperature	AI	Space Sensor

B. Photocell: Provide a photo sensor mounted on the north side of the building. Location is to be approved by Owner / Architect / Engineer.

POINT DESCRIPTION	TYPE	DEVICE
Photocell	AI	Contact

C. Interior Lighting Control:

Building Management Control System Scope

The lighting control system, as indicated on the electrical drawings lighting control details, will be provided with lighting control system BMCS interface devices via DLM room controllers, refer to Electrical Drawings and Details. The BMCS system shall send a occupied and unoccupied signal to the lighting control system BMCS interface devices based on a BMCS schedule.

The BMCS provider shall provide an additional 8 hours of technician support to ensure the lighting control system is commissioned and operating as described.

Lighting Control System Scope

When the Lighting Control system BMCS interface devices in an area receives an occupied signal from BMCS, the lights in that area shall remain in their current state

(typically off) but allow any local switch in that area to control the lighting in that space.

When the Lighting Control system receives an unoccupied signal from BMCS, the lighting control system shall flash the lights, and after a delay, the lights in that area shall be swept off by the lighting control system. In this unoccupied mode, the lighting control system shall allow any local light switch in that area to allow the lights to be controlled locally for 2-hours upon being switched on by the local switch. After the 2-hours, the lighting control system enable signal shall expire, and the lights shall again flash a warning, and if the local switch is not again activated, the lights shall be turned off by the lighting control system.

POINT DESCRIPTION	TYPE	DEVICE
Interior Lighting Control		DLM Room Controller

D. Exterior Lighting Control
1. Provide individual time/photo-cell and time based control of each lighting contactor specified in Division 26.
   a. Provide separate control of each contactor.
2. The exterior lights shall be controlled by the BMCS using both a combination of photosensor, time schedules and astronomical sunrise/sunset. The exterior lights shall automatically come on when the sun sets based on the longitude and latitude coordinates of the facility (adjustable +/- 30 minutes). At 11 p.m. (adjustable) the time schedule shall turn off the exterior lights. At 4:00 a.m. (adjustable) the exterior lights shall automatically turn on based on time schedule. Upon sunrise, which shall be based on longitude / latitude of the facility the exterior lights shall turn off.
3. Between sunrise and sunset, photo-sensor shall only deactivate all exterior lighting when ambient light levels are above set point (adjustable).

POINT DESCRIPTION	TYPE	DEVICE
Lighting Contactor	DO	Control Relay
Momentary Control Switch	DI	Switch

E. Kitchen Utility Usage: Wire and interface with all meters provided by others as indicated on the drawings and shown below. Provide a separate graphics page for the following items to allow for quick referencing.
1. Kitchen Water Service - Provide digital monitoring and logging, through the BMCS, of the kitchen cold water usage meter and kitchen hot water usage meter. Water meters shall have 4-20 mA signal or pulse for conversion by BMCS into water flow rates. BMCS shall log data for use.
2. Kitchen Gas Service: Provide digital monitoring and logging, through the BMCS, of the of the kitchen gas meter. Gas meters shall have 4-20 mA signal or pulse for conversion by BMCS into water flow rates. BMCS shall log data for use.
3. Kitchen Electrical Service: Provide digital monitoring and logging, through the BMCS, of each Current Transformer Meter added to all kitchen electrical panels and equipment. This shall include the normal power and emergency electrical panels. BMCS shall log data for use.
4. Kitchen Hydronic Chilled and Hot Water Service – Provide meters, digital monitoring and logging, through the BMCS, of the Chilled and Hot water flow rates at the Kitchen Air Handling Unit. Provide separate water meters for each service. BMCS shall log data for use.
5. Provide a separate graphics page for all Kitchen meters. The link to the graphics

page shall be categorized under Misc. Equipment. Equipment and trended on a 15-minute interval.

F. Freezer/Cooler Temperature Monitoring:
1. The existing cooling and freezer are being replaced. Provide new analog temperature sensor located in the freezer compartment and cooler compartment.

POINT DESCRIPTION	TYPE	DEVICE
Freezer Alarm	AI	RTD
Cooler Alarm	AI	RTD

G. The new athletic storage building shall be controlled locally and shall not be part of the BMCS system.

H. Terminal Unit relocation – This contractor shall remove and install all new controls to support terminal unit relocation. This work shall include all new wiring and temperature sensor.

3.8 TERMINAL UNIT COORDINATION

A. Equipment furnished in this section and installed by Section 23 36 16:
1. Automatic temperature control card (DDC).
2. Damper Actuator

B. Equipment furnished and installed by Section 23 36 16:
1. Damper.
2. Multi-point flow sensor.
3. Power transformer.
4 Controller enclosure.

3.9 VARIABLE VOLUME AIR HANDLING UNITS WITH SPLIT DEHUMIDIFICATION UNIT MOUNTED ON TOP (AHU-A-5/AHU-A-5-A)

A. Split dehumidification units are furnished with a chilled water coil and a hot water heating coil in the PREHEAT position and supply fan. Control shall be as follows:
1. A duct mounted sensor sensing supply air temperature shall, acting through the Direct Digital Control Panel, modulate the valve on the cooling coil and the valve on the hot water coil, in sequence, to maintain the desired discharge air temperature as scheduled. The supply fan shall be started and stopped from the BMCS System.
2. Provide a temperature low limit switch located on the discharge side of the hot water preheat coil or the entering side of the cooling coil to de-energize the air handling unit and supply fan, close the outside air damper, open the hot water valve 100%, start the boiler and hot water pump, signal an alarm to the BMCS when the temperature drops below 32°F. Device shall be manual reset.
3. Open OA damper and start supply fan before starting Air Handling Unit. Provide end switch to ensure damper is in the open position in either the manual (hand) or auto position of the motor starter.

POINT DESCRIPTION	TYPES	DEVICE
Supply Fan Start/Stop	DO	Control Relay
AHU Status	DI	Current Sensitive Relay

POINT DESCRIPTION	TYPES	DEVICE
Variable Speed Fan	AO	Motor Controller
Cooling Coil Leaving Air Temp.	AI	Averaging Sensor
Heating Coil Leaving Air Temp.	AI	Averaging Sensor
CHW Valve	AO	Electronic Operator
Outside Air Damper	DO	Electronic Operator
Freeze Status	DI	Temperature Low Limit Switch
HW Pre Heat Valve	AO	Electronic Operator

B. Units consist of a chilled water coil, a fan, a variable speed drive, and outside air fan.

C. The unit shall be started and stopped from the BMCS system.

D. Discharge air temperature control:
   1. A sensor far enough from the fan discharge to be truly representative of the average temperature shall modulate the valve on the cooling coil to maintain setpoint. Reference drawing schedule for discharge temperature.

E. Variable air volume control:
   1. Duct static pressure sensor shall be located in the duct at a position approximately 2/3 the distance from the fan in the longest duct run. Location is to be approved by Engineer and coordinated with Section 23 05 93.
   2. The static pressure sensors shall, through the DDC panel, accept the signal from the operating control sensor to:
      a. Transmit a signal to the supply fan motor speed controller.
      b. Modulate the fan speed to maintain the desired static pressure.
      c. Coordinate signal with the fan motor speed controller.
   3. Install a static pressure high limit safety device to de-energize the system.
      a. Manual reset.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
AHU Status	DI	Air Flow Sensing Switch
Discharge Air Temperature	AI	Space Thermistor
CHW Valve	AO	Electronic Operator
Duct Static Pressure	AI	Static Pressure Sensor
Variable Speed Fan	AO	Motor Controller

3.10 CONSTANT VOLUME / VARIABLE VOLUME TERMINAL UNITS

A. Each unit shall consist of a pressure independent variable volume damper, a constant

volume fan, and a hot water heating coil. The fans shall be interlocked with the AHU fan. Constant volume terminal shall start before AHU fan starts. Controls shall be as follows:

1. A space temperature sensor shall, through the direct digital control system, modulate the variable volume damper from full open to a minimum airflow rate to maintain room setpoint. If heating is required, the temperature sensor shall modulate the hot water control valve to maintain room setpoint with the variable volume damper in the minimum airflow position.
2. Control valve, and control valve operator are specified in this section.
3. The Controls Contractor shall furnish the terminal box manufacturer with a controller to be factory mounted. The controller shall display cfm, temperature, damper position, and hot water valve position.

POINT DESCRIPTION	TYPES	DEVICE
Space Temperature	AI	Space Thermistor
Primary Air	AO	Variable Volume Damper Operator
HW Valve	AO	Electronic Operator
Start/Stop	DO	Control Relay
Discharge Air Temperature	AI	Duct Thermistor

3.11 SINGLE ZONE AIR HANDLING UNIT WITH SPLIT DEHUMIDIFICATION UNIT MOUNTED ON TOP (AHU-4/AHU-4-A)

A. Split dehumidification units are furnished with a chilled water coil and a hot water heating coil in the PREHEAT position. Control shall be as follows:

1. A duct mounted sensor sensing supply air temperature shall, acting through the Direct Digital Control Panel, modulate the valve on the cooling coil and the valve on the hot water coil, in sequence, to maintain the desired discharge air temperature of 55°F. The supply fan shall be started and stopped from the BMCS System.
2. Provide a temperature low limit switch located on the discharge side of the hot water preheat coil or the entering side of the cooling coil to de-energize the air handling unit and supply fan, close the outside air damper, open the hot water valve 100%, start the boiler and hot water pump, signal an alarm to the BMCS when the temperature drops below 32°F. Device shall be manual reset.
3. Open OA damper and start supply fan before starting Air Handling Unit. Provide end switch to ensure damper is in the open position in either the manual (hand) or auto position of the motor starter.

POINT DESCRIPTION	TYPES	DEVICE
Supply Fan Start/Stop	DO	Control Relay
AHU Status	DI	Air Flow Sensing Switch
Discharge Air Temperature	AI	Duct Thermistor
CHW Valve	AO	Electronic Operator

POINT DESCRIPTION	TYPES	DEVICE
Outside Air Damper	DO	Electronic Operator
Freeze Status	DI	Temperature Low Limit Switch
HW Pre Heat Valve	AO	Electronic Operator

B. AHU Consists of a chilled water coil and a hot water heating coil in the REHEAT position. Control shall be as follows:

1. A room thermistor sensing space temperature shall, acting through the Direct Digital Control Panel, modulate the valve on the cooling coil and the valve on the hot water coil, in sequence, to maintain the desired space temperature. The air-handling unit shall be started and stopped from the BMCS System.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
AHU Status	DI	Air Flow Sensing Switch
Space Temperature	AI	Space Thermistor
HW Valve	AO (1)	Electronic Operator
CHW Valve	AO (1)	Electronic Operator
Outside Air Damper	DO	Electronic Operator
Discharge Air Temperature	AI	Duct Thermistor

3.12 KITCHEN HOOD SUPPLY AIR HEATING SYSTEM

A. This system consists of a supply fan and a duct mounted hot water coil.

B. A thermistor sensing discharge air from the hot water coil shall, through the direct digital control panel, modulate the hot water valve to maintain a 70°F discharge temperature (adjustable).

C. Provide an electric low temperature switch located in the discharge of the hot water preheat coil to de-energize the supply air fan and close the outside air damper, open the hot water valve 100%, start the hot water pump, and signal the BMCS, when temperature drops below 32°F. Device shall be manual reset.

D. Provide a space temperature sensor to limit the rise in temperature during unoccupied times.

E. Provide interlocks to disable the fans during unoccupied times.

POINT DESCRIPTION	TYPES	DEVICE
Fan Start/Stop	DO	Control Relay

POINT DESCRIPTION	TYPES	DEVICE
Discharge Air Temperature	AI	Discharge Thermistor
HW Valve (Preheat)	AO	Electronic Operator
Freeze Status	DI	Low Temperature Switch
Space Sensor	AI	Space Thermistor

3.13 HYDRONIC AND DOMESTIC BOILER CO MONITOR SYSTEM

A. Replace the existing CO monitoring system in the main boiler room as part of the project scope.

B. This contractor shall provide and wire interlocks from equipment to the CO monitor system. Upon alarm through the sensor all the boiler equipment, i.e. boiler and pumps and domestic water heaters, shall be deactivated. CO monitor shall provide a visual and audible alarm. Provide a sign at each entrance to boiler room to indicate information about system.

C. Upon Alarm of CO monitor, notify users via text message.

D. CO Monitor control shall be provided at each room that contains gas fired hydronic boilers or domestic water heaters/boilers.

POINT DESCRIPTION	TYPES	DEVICE
CO Monitor	DI	Control Panel
System Start/Stop	DO	Control Relay

3.14 REFRIGERANT MONITORING / VENTILATION CENTRAL PLANT APPLICATIONS

A. Replace the existing refrigerant monitor in its entirely at the central plant as part of the project scope.

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.

B. 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.

C. 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.

D. 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 modulated to full speed via the VFD. Label switches / buttons per Code.

E. 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.

F. During normal plant operation the plant exhaust fan shall operate via the VFD at minimum speed as scheduled to provide general plant exhaust.

POINT DESCRIPTION	TYPE	DEVICE
Refrigerant Monitor / Sensors	AI	Control Panel
Emergency Shut	DI	Break Glass Switch
Emergency Ventilation	DI	Emergency Ventilation Button
Fan Start/Stop	DO	Control Relay
Fan Status	DI	Current Switch
Variable Speed Motor	AO	Motor Controller
System Start/Stop	DO	Control Relay

3.15 FAN COIL UNIT WITH HUMIDITY CONTROL (CHFCU-B-1)

A. Each fan coil unit is furnished with a chilled water coil and hot water coil. Control shall be as follows:
   1. A space temperature sensor shall, acting through a terminal equipment controller, modulate the valves on the chilled water cooling coil and hot water reheat coil in sequence to maintain the desired space temperatures.
   2. A space humidity sensor located in the return air and/or in the space shall acting through the DDC panel, modulate the valve on the chilled water coil to maintain 55 degree discharge air when space is above its humidity setpoint and in dehumidification.
      a. The space temperature sensor shall modulate the valve on the hot water reheat coil to maintain space temperature.
   3. An averaging temperature sensor, located in the preheat discharge shall modulate the hot water control valve to maintain the desired setpoint.
   4. Outside for unit is delivered through a roof mounted outside air intake. The outside air damper shall be activated during the occupied periods.
   5. Provide a temperature low limit switch located on the discharge side of the hot water preheat coil or the entering side of the cooling coil to de-energize the air handling unit, close the outside air damper, open the hot water valve 100%, start the boiler and hot water pump, signal an alarm to the BMCS when the temperature drops below 37°F. Device shall be manual reset.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
CHW Valve	AO	Electronic Operator
Space Temperature	AI	Space Thermistor
HW valve	AO	Electronic Operator
Discharge Air Temperature	AI	Duct Thermistor
Freeze Status	DI	Temperature Low Limit Switch
Outside Air Damper	DO	Electronic Operator

3.16 AIR COOLED CHILLER REPLACEMENT

A. The existing air cooled chiller and associated chilled water pump located at the main central plant is being replaced. The new air cooled chiller and pump will include additional capacity. The existing control sequences shall be remain and be reused.

B. BMCS contractor shall remove all existing wiring and end devices as required for removal of existing chiller and pump. Provide new wiring conduit and end devices to maintain existing sequence and to provide points as listed below for both chiller and pump.

C. The new pump is being equipped with a new variable frequency drive. Pump shall be used for soft start and balancing only.

D. Provide interface to chiller through the chiller BacNet interface card. Provide a graphic page for the interface card that displays all values available.

POINT DESCRIPTION	TYPE	DEVICE
Chiller Start/Stop	DO	Control Relay
Chiller Status	DI	Safety Alarm Relay
Chiller Alarm	AI	Chiller Control Module
Chiller LWT Temperature Reset	AO	Chiller Control Module
Pump Start/Stop	DO	Control Relay
Pump Status	DI	Current Sensitive Relay
Pump VFD	AO	Variable Frequency Drive
Chiller Supply Water Temperature	AI	Temperature Sensors
Chiller Return Water Temperature	AI	Temperature Sensors

3.17 KITCHEN HOOD SUPPLY AIR HEATING SYSTEM

A. This system consists of a duct mounted hot water coil.

B. A thermistor sensing discharge air from the hot water coil shall, through the direct digital control panel, modulate the hot water valve to maintain a 70°F discharge temperature (adjustable).

C. Provide an electric low temperature switch located in the discharge of the hot water preheat coil to de-energize the supply air fan and close the outside air damper, open the hot water valve 100%, start the hot water pump, and signal the BMCS, when temperature drops below 32°F. Device shall be manual reset.

D. Provide interlocks to disable the fans during unoccupied times.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
Discharge Air Temperature	AI	Discharge Thermistor
HW Valve (Preheat)	AO	Electronic Operator
Freeze Status	DI	Low Temperature Switch

3.18 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 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.

3.19 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.

3.20 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.

3.21 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 09 34

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

A. Products provided by the Building Management and Control System (BMCS) Contractor.
   1. Control Valves
   2. Dampers
   3. Wells for sensors installed in piping system
   4. Flow Meters

PART 3 - EXECUTION

3.1 COORDINATION

A. Coordinate with the Building Management and Control System (BMCS) Contractor.
   1. Provide project-scheduling information to the BMCS Contractor to allow ample time for purchase of equipment and devices.
   2. Schedule periodic project meetings to review progress and coordination issues.
   3. Submit a written report, to the Architect/Engineer, on a monthly basis stating status of coordination effort.

B. The BMCS contractor will submit shop drawings to this contractor for review and coordination processing.

3.2 INSTALLATION

A. This Contractor will be responsible for the following:
   1. Installation of control valves for HVAC equipment.
   2. Installation of dampers for HVAC equipment.
   3. Installation of temperature sensor wells in piping.
   4. Installation of pressure taps in piping system.
   5. Installation of flow meter taps in piping system.

B. Install the above material under the direction of the Building Management and Control System (BMCS) Contractor.

END OF SECTION

SECTION 23 20 00

HVAC PIPE AND PIPE FITTINGS - GENERAL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install pipe and pipe fittings for piping systems specified in Division 23 - Mechanical.

1.2 RELATED WORK

A. Division 23 Mechanical:
   1. Earthwork.
   2. Valves, Strainers and Vents.
   3. Vibration Isolation.
   4. Insulation.
   5. Other Piping Sections

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. The particular type of pipe and fittings for each system is specified in the individual sections.

2.2 JOINTS

A. Make screwed joints using machine cut USASI taper pipe threads. Apply a suitable joint compound to the male threads only. Ream the pipe to full inside diameter after cutting. All-thread nipples are not permitted.

B. Dissimilar Metals. Make joints between copper and steel pipe and equipment using insulating unions or couplings such as Crane Company #1259; EPCO as manufactured by EPCO Sales, Inc.; or an approved equal.

C. Solder joints.
   1. Prior to making joints, cut pipe square and ream to full inside diameter. Clean exterior of pipe and socket. Apply a thin coat of suitable fluxing compound to both pipe and socket, and fit parts together immediately.
   2. Heat assembled joint only as required to cause the solder to flow. Run the joint full, slightly beaded on the outside, and wipe to remove excess solder.
   3. Use silver brazing alloy or Sil-Fos on refrigerant piping and on underground piping. Use lead free solder on all other copper piping.

D. Make welded joints as recommended by the standards of the American Welding Society. Ensure complete penetration of deposited metal with base metal. Provide filler metal suitable for use with base metal. Keep inside of fittings free from globules of weld metal. The use of mitered joints is not approved.

E. Flanged.
   1. Prior to installation of bolts, center and align flanged joints to prevent mechanical pre-stressing of flanges, pipe or equipment. Align bolt holes to straddle the vertical, horizontal or north-south centerline. Do not exceed 3/64"

per foot inclination of the flange face from true alignment.

2. Use flat-face companion flanges only with flat-faced fittings, valves or equipment. Otherwise, use raised-face flanges.
3. Install gaskets suitable for the intended service and factory cut to proper dimensions. Secure with manufacturers recommended gasket cement.
4. Use ANSI nuts and bolts, galvanized or black to match flange material. Use ANSI 316 stainless steel nuts and bolts underground. Tighten bolts progressively to prevent unbalanced stress. Draw bolts tight to ensure proper seating of gaskets.
5. Use carbon steel flanges conforming to ANSI B16.5 with pipe materials conforming to ASTM A 105 Grade II or ASTM A 108, Grade II, ASTM A 53, Grade B. Use slip-on type flanges on pipe only. Use welding neck type flanges on all fittings. Weld slip-on flanges inside and outside.
6. Keep flange covers on equipment while fabricating piping. Remove when ready to install in system.

F. Mechanical Joints: Provide a stuffing box type mechanical joint adapted to use gasket, cast iron gland and bolts. Coat bolts with bitumastic enamel. Use joint parts similar in design to one of the following:

1. Doublex Simplex Joint manufactured by the American Cast Iron Pipe Company, Birmingham, Alabama.
2. U.S. joints manufactured by the United States Pipe and Foundry Company, Burlington, New Jersey.
3. Boltite Joint manufactured by the McWane Cast Iron Pipe Company, Birmingham, Alabama.
4. Flexlamp manufactured by the National Cast Iron Pipe Company, Birmingham, Alabama.

2.3 UNIONS

A. Use 150 lb. standard (300 lb. WOG) malleable iron, ground joint unions with bronze seat. Provide flanged joints on piping 2-1/2" and larger.

1. Where pipe material of different types join, use a dielectric union. Union shall be threaded, solder or as required for its intended use.

2.4 BRANCH CONNECTIONS

A. Pipe 2" and Smaller: For threaded piping, use straight size reducing tee. When branch is smaller than header, a nipple and reducing coupling or swagged nipple may be used.

B. 2-1/2" through 36": For welding piping, when branch size is the same as header size, use welding tee. For threaded branch connections, use 3000 lb. full coupling or Thread-o-let welded to header.

2.5 GASKETS

A. High Temperature Piping: Provide 1/16" thick ring gaskets of aramid reinforced SBR such as Garlock #3200 or 3400 or equal by Advanced Products and Systems.

B. Other Piping: Provide ring rubber gaskets, Garlock #7992 or equal by Advanced Products and Systems. Use 1/8" thick cloth reinforced neoprene gaskets. For smaller than 6", use 1/16" thick gasket.

2.6 FLOORS AND CEILING PLATES

A. Provide chrome-plated floor and ceiling plates around pipes exposed to view when passing through walls, floors, partitions, or ceilings in finished areas; size plates to fit pipe or insulation and lock in place.

2.7 DOMESTIC MANUFACTURE

A. All piping material, pipe and pipe fittings shall be manufactured in the United States of America.

PART 3 - EXECUTION

3.1 PIPE FABRICATION AND INSTALLATION

A. Make piping layout and installation in the most advantageous manner possible with respect to headroom, valve access, opening and equipment clearance, and clearance for other work. Give particular attention to piping in the vicinity of equipment. Preserve the required minimum access clearances to various equipment parts, as recommended by the equipment manufactured, for maintenance.

B. Cut all pipes to measurement determined at the site. After cutting pipe, remove burrs by reaming. Bevel plain ends of ferrous pipe.

C. Install piping neatly, free from unnecessary traps and pockets. Work into place without springing or forcing. Use fittings to make changes in direction. Field bending and mitering is prohibited. Make connections to equipment using flanged joints, unions or couplings. Make reducing connections with reducing fittings only.

D. Install piping without tapping out of the bottom of pipe.

3.2 WELD

A. Weld and fabricate piping in accordance with ANSI Standard B31.1, latest edition, Code for Pressure Piping.

B. Align piping and equipment so that no part is offset more than 1/16". Set fittings and joints square and true, and preserve alignment during welding operation. Use of alignment rods inside pipe is prohibited.

C. Do not permit any weld to project within the pipe so as to restrict flows. Tack welds, if used, must be of the same material and made by the same procedure as the completed weld. Otherwise, remove tack welds during welding operation.

D. Do not split, bend, flatten or otherwise damage piping before, during or after installation.

E. Remove dirt, scale and other foreign matter from inside piping before tying into existing piping sections, fittings, valves or equipment.

F. Bevel ends of ferrous pipe.

3.3 OFFSETS AND FITTINGS

A. Due to the small scale of drawings, the indication of offsets and fittings is not possible. Investigate the structural and finish conditions affecting the work and take steps

required to meet these conditions.

B. Install pipe close to walls, ceilings and columns so pipe will occupy minimum space. Provide proper spacing for insulation coverings, removal of pipe, special clearances, and offsets and fittings.

3.4 SECURING AND SUPPORTING

A. Support piping to maintain line and grade, with provision for expansion and contraction. Use approved clevis-type or trapeze-type hangers connected to structural members of the building. Single pipe runs to be supported by approved clevis type hangers. Multiple pipe runs to be supported by approved trapeze type hangers. Do not support piping from other piping or structural joist bridging. Review structural drawings for additional information.

B. Provide supports both sides and within 12” of each horizontal elbow for pipe 6" and larger.

C. Support vertical risers with steel strap pipe clamps of approved design and size, supported at each floor. Support piping assemblies in chases so they are rigid and self-supported before the chase is closed. Provide structural support for piping penetrating chase walls to fixtures. On chilled water pipe supports shall be outside the insulation.

D. Where insulation occurs, design hangers to protect insulation from damage. Pipe saddles and insulation shields, where required, are specified in the appropriate insulation section and are sized in accordance with the schedule on the drawings.

E. Install trapeze hangers, properly sized, to support the intended load without distortion. Use hangers with 1-1/2” minimum vertical adjustment.

F. Use electro-galvanized or zinc plated beam clamps if acceptable to the structural engineer, threaded rods, nuts, washers and hangers. All hanger rods shall be trimmed neatly so that no more than 1 inch of excess hanger rod protrudes beyond the hanger nut. Use only on beams as directed by the Structural Engineer.

G. At outdoor locations, all supports, brackets and structural members shall be hot-dipped galvanized.

H. Provide hangers within 3' of pipe length from all coil connections.

I. Support spacing: As recommended by the project structural engineer and support manufacturer, but not more than listed below. Not to exceed spacing requirements of smallest pipe.

Pipe Size	Copper & Steel Max. Support Spacing, Ft.	Cast Iron Max. Support Spacing, Ft.	Minimum Rod Diameter, Inches
1" & smaller	6	5	3/8
1-1/4" & 1-1/2"	8	5	3/8
2"	10	5	3/8
3"	10	5	1/2
4" & 5"	10	5	5/8
6" and above	10	5	3/4

3.5 PIPE SUPPORTS

A. Provide P1001 or P 5000 Unistrut metal framing members and appurtenances for pipe support. Hot-dip galvanized members and appurtenances when located outside. Sagging of pipes or supports is not acceptable.

B. Adjustable clevis hangers shall be used for single pipe supports; Anvil Fig. 260. When oversized clevis is used, a nipple shall be placed over the clevis bolt as a spacer to assure that the lower U-strap will not move in on the bolt. Provide adjustable clevis with a nut / washer above and below the hanger on the support rod. Ring type clevis hangers are not acceptable.

C. Provide Anvil Figure 45 galvanized or primed and painted channel assembly for trapeze hangers.

3.6 PIPE SUPPORTS ON ROOF

A. Support condensate drain pipe on roof with Portable Pipe Hanger Model PP-10 with roller and fully adjustable height throughout pipe run. Base material shall be high density / high impact polypropylene with UV inhibitors and anti-oxidants. Provide with hot dip galvanized rod finish and framing. Nuts and washers shall be hot dip galvanized.

3.7 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.

1. Acceptable manufacturer shall be Spirovent Series HV by Spirotherm, TACO High Velocity 4900, Thrush High 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 21 23

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.

B. Section 23 05 48 HVAC Vibration Isolation

C. Section 23 05 50 Noise Control for Mechanical Systems

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.

1.6 DELIVERY OPTIONS

A. Manufacturer shall provide quick shipment options to minimize product lead times.

PART 2 - PRODUCTS

2.1 VERTICAL IN-LINE (VIL) PUMPS

A. Pump Construction:
1. Pump casing, cast iron with 125 psig ANSI/PN16 flanges for working pressure below 175 psig at 150°F and ductile iron with 250 psig ANSI / PN25 flanges for working pressure to 375 psig at 150°F.
2. Suction and discharge connections shall be flanged and the same size and shall be drilled and tapped for seal flush and gauge connections.
3. Impeller: Bronze, fully enclosed type; dynamically balanced, two-plan balancing is required where installed impeller diameter is less than 6 times the impeller width.
4. Shaft: Provide 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.

B. Single stage, single or double suction type, with pump characteristics which provide rising heads to shut off. Refer to pump schedule for pump flows and heads and motor speed, enclosure, efficiency and power requirements and other system conditions.

C. Pump Motor:
1. Premium efficiency
2. Totally enclosed fan cooled
3. Cast iron frame and end plate
4. (2) Forge steel lifting eye
5. Over-sized conduit box with ground lug
6. So sized with relation to the pump impeller that the brake horsepower requirements will not overload the motor at any point on the pump curve.
7. Critical speed of the pump shall be at minimum 115% of the operating speed listed in the pump schedule.
8. Designed for Variable Frequency Drive Application
9. Greaseable bearings rated for a minimum of 200,000 hours.
10. Minimum Efficiency

3 hp	1800 rpm	89.5%
5 hp	1800 rpm	90.2%
7.5 hp	1800 rpm	91.7%
10 hp	1800 rpm	91.7%
15 hp	1800 rpm	92.4%
20 hp	1800 rpm	93%
25 hp	1800 rpm	93.6%
30 hp	1800 rpm	94.1%
40 hp	1800 rpm	94.5%
50 hp	1800 rpm	94.5%
60 hp	1800 rpm	95%
75 hp+	1800 rpm	95.4%

D. Data plates:
1. Provide the pump with a nameplate constructed of 300 series stainless steel securely fastened to pump casing with stainless steel pins.
2. Locate the nameplate for easy visibility.
3. Clearly stamp the rating conditions and other data below, as a minimum, on the nameplate.
    a. Manufacturer, address, telephone number
    b. Pump model number
    c. Pump serial number
    d. Size (including impeller diameter scheduled in inches)
    e. Type
    f. Equipment designation as listed on the pump schedule.
    g. Flow scheduled (gallons per minute)
    h. Dynamic head scheduled (feet of water)
    i. Efficiency (percent)
    j. Shut-off head (feet of water)
    k. Speed (rpm)
    l. Brake horsepower
    m. Maximum brake horsepower with rated impeller
    n. Rotation
    o. Maximum allowable pressure (psig)

E. The schedule on the drawing sets forth the type of pump and GPM required.
1. The head capacities and horsepower are for bidding purposes only.

2. Make pump selection based on actual system calculations.

F. Acceptable manufacturers:
1. Bell & Gossett
2. Armstrong Series 4300
3. Aurora
4. Taco
5. Grundfos
6. Patterson

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 23 00

REFRIGERANT PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install copper tubing, valves, strainers and sight glass for refrigerant piping.

1.2 RELATED WORK

A. Division 23 Mechanical.
   1. Pipe and Pipe Fittings
   2. Piping Insulation

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Furnish refrigerant piping of Type K hard-drawn copper tubing with sweat-type, wrought copper fittings. Cast fittings are not permitted.

2.2 SERVICE VALVES

A. Provide angle or globe service valves, with sweat connections. Use packed-type, wrench operated, valves with gasketed seal cap and back seat feature. Furnish valves designed for refrigerant service, in conformance with the ARI code.

B. Place service valves at the inlet and outlet of each compressor, on both sides of each strainer and solenoid valve, and as otherwise shown and specified.

2.3 SOLENOID VALVES

A. Furnish pilot-operated, floating-piston solenoid valves suitable for operation with refrigerant.

B. Use valves with a bronze body and sweat-type connections.

C. Provide stainless steel stem and plunger assembly and a stainless steel piston.

D. Furnish sealed and moisture proof solenoid coils.

E. Use electrical characteristics of 115 volt, 60 Hertz.

2.4 SIGHT GLASSES

A. Provide suitable moisture and liquid sight glass in the liquid line leaving the condenser or receiver.

2.5 FILTER DRYER

A. Furnish replaceable core liquid line filter dryer.

B. Provide filter dryer constructed to permit the removal of the core element without removing the filter dryer from the line.

PART 3 - EXECUTION

3.1 BRAZING

A. During the brazing process, dry nitrogen shall be purged through the tubing to prevent oxides from forming.

3.2 PRESSURE TEST

A. After refrigeration and piping system items are installed, charge the system with dry nitrogen and test to 450 psig.
   1. Test joints with a Halide torch or an electronic leak detector.
   2. Repair leaks and retest each system until proved tight.

3.3 EVACUATION AND DRYING

A. After refrigerant system has been pressure-tested, connect a suitable vacuum pump and evacuate piping system, including lines and equipment.
   1. Maintain a vacuum as high as practicable for long enough to evaporate the moisture in the system (at least 48 hours).
   2. Check the humidity within the system with a wet bulb indicator, and maintain the vacuum until the wet bulb temperature is reduced to -40°F. After the system has been evacuated and dried, break the vacuum by charging proper refrigerant into the system.

3.4 PIPE SIZE

A. Pipe shall be routed and sized per condensing unit manufacturer’s instructions.

END OF SECTION

SECTION 23 25 13

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 Agency and that are labeled as required by law.

C. Provide electrical products that have been tested, listed and labeled by Underwriters Laboratories and comply with the National Electrical Manufacturers Association Standards.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Nalco Water – Ecolab (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.

PART 3 – EXECUTION

3.1 INSTALLATION/START-UP

A. In accordance with manufacturer's recommendations.

B. Anchor the chemical filter feeder to a concrete housekeeping pad using wedge type expansion anchors.

C. Clean and flush closed loops systems.
1. Clear water flush systems before introducing chemical cleaners.
2. Chemical cleaner shall be introduced into the systems to remove construction related oils, greases, threading compounds, and silt.
3. Chemical Cleaner shall passivate and pre-film pipe system.

3.2 WATER ANALYSIS

A. The chemical treatment agency shall provide the services of a testing laboratory to perform a site water analysis. As a minimum, conduct the following tests in accordance with ASTM standards and to the satisfaction of the Owner/Architect/Engineer.
1. Silica in water and wastewater.
2. Acidity or alkalinity of water.
3. Iron in water.
4. Hardness of water.
5. Ph of water.
6. Particulate and Dissolved Matter, Solids or Residue in Water.
7. Turbidity in water.
8. Corrosivity of water in absence of heat transfer.
9. Standard practices for sampling water.

B. Take water samples in accordance with ASTM.

C. Prepare a test report in accordance with ASTM for each of the tests conducted.

D. Submit the test reports to the Architect/Engineer.

3.3 CHEMICAL TREATMENT

A. The chemical treatment agency shall provide complete services necessary for chemically cleaning and treatment the following systems:
1. Chilled water.
2. Hot water.

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 31 13

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 summit details of duct fittings, including particulars such as gauge sizes, welds, and configurations prior to starting work.

B. Submit product data and sealing materials to be used.

C. Submit sound attenuation data.

D. Submit shop drawings in plan, elevation and sections, and three-dimensional view showing equipment in mechanical equipment areas.

PART 2 - PRODUCTS

2.1 STANDARDS AND CODES

A. Except as otherwise indicated, sheet metal ductwork material and installation shall comply with the latest edition of SMACNA HVAC Duct Construction Standards. Air distribution devices (such as dampers) included in this specification shall comply with the latest applicable SMACNA Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems and NFPA 90A.

2.2 DUCT MATERIAL AND CONSTRUCTION

A. Except for the special ducts specified below use lock forming quality prime galvanized steel sheets or coils up to 60" wide. Stencil each sheet with gauge and manufacturer's name. Stencil coils of sheet steel throughout on 10' centers with gauge and manufacturer's name. Provide certification of duct gauge and manufacturer for each size duct.

B. Rectangular low and medium pressure duct constructed of sheet metal in accordance with the latest edition of SMACNA HVAC Duct Construction Standards.

C. Medium pressure oval and round ductwork shall be spiral seam. Spiral lock-seam SMACNA Type RL-1. Fittings shall be welded construction.
1. Galvanized

D. Low pressure round ducts shall be shop fabricated with snap lock longitudinal seams. Ducts shall be constructed for a minimum of 2" w.g. static pressure.

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 Manufactures
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 broken and rigidly braced with galvanized angles. Gauges and bracing shall conform to SMACNA recommendations for ductwork of like sizes. Openings for fans, access doors, etc., shall be framed with galvanized steel angles.

B. Provide access doors.

3.17 AUXILIARY DRAIN PANS

A. 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 34 16

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 35 16

WELDING FUME EXHAUST SYSTEM

PART 1 – GENERAL

1.1 WORK INCLUDED

A. Provide the multi-position welding fume exhaust system.

B. Construct according to the Industrial Ventilation Manual.

C. System capacity as scheduled.

1.2 SUBMITTALS

A. Submit product data sheets of the vibration isolation.

B. Submit a 3' long sample of the flexible exhaust hose, together with product data sheet.

C. Submit shop drawings of the entire duct system and components.

D. Submit shop drawings on structural supports.

E. Submit fan performance curve for each fan.
   1. Plot fan volume against static pressure, horsepower and efficiency.
   2. Show point of rating based on static requirements of the system.

F. Submit product data sheets on the electrostatic air cleaner.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Car-Mon

B. Monoxivent

C. National

D. AAF

E Systems of Garage Ventilation

2.2 OUTDOOR DUCTWORK

A. Ductwork outdoors welded watertight.
   1. Coat welded areas with cold galvanizing compound.

B. Paint with two coats of industrial fume resistant enamel.
   1. Galvanize prime coat.

2.3 INDOOR DUCTWORK

A. Tapered galvanized duct system.

B. 10' long flexible exhaust hoses at each position.

1. Fiberglass/neoprene with coated steel coil.
2. Outside weld proof Mylar coating.
3. Fire proof.
4. Resistant to puncture by hot welding rod.

C. Four inch diameter fume receptor with screen and magnets for each position.
1. Provide magnets with sufficient strength to support the receptor and hose when suspended from the bottom of a metal plate.

2.4 SLOTTED FUME HOODS

A. 18 gauge welded stainless steel construction.

B. Exhaust outlet size shall be full size of connected ductwork. Refer to drawings.

C. Provide manual balancing damper on outlet of hood.

D. Hood length as indicated on drawings.

2.5 INTERNAL SUPPORT SOURCE CAPTURE ARM

A. Internally supported source capture arm with a minimum of four pivot points and 180 to 360 degrees swivel.

B. Arm shall be provided with internal support structure, weld proof hose (300°F rated), mounting brackets, and collection hood.

2.6 ELECTROSTATIC AIR CLEANER

A. Provide high efficiency electrostatic filtration.
1. Solid state voltage limiting power pack.
2. Primary and Secondary status lights.
3. Safety interlock.

B. Provide a charge neutralizer for the heavy concentrations of metallic particulate in the weld fume.
1. Power supply to activate the ionizing wires on the collector cells.

C. Provide an inlet filter as specified in Section 23 41 00.

D. Provide with exhaust fan as specified.

2.7 EXHAUST FAN

A. Drive assembly:
1. Sized for 50% overload.
2. Matched belts.
3. Adjustable pitch motor pulley and fixed pitch fan pulley.
4. Cast iron pulleys keyed to the shaft.
5. Totally Enclosed Fan Cooled inverter duty motor.
6. Ventilated, steel, weatherproof drive cover.

B. Fan shall be:
1. Statically and dynamically balanced.
2. Selected for the design air quantities and pressure of the system.
3. Selected to operate at or near its maximum efficiency point when handling the

required air quantity and static pressure.

C. Select the motor so that the brake horsepower required to deliver the design air quantity at the system static pressure will not exceed the motor nameplate rating.

D. Fan construction:
   1. Backward inclined wheel.
   2. Non-overloading.
   3. Paint all parts exposed to the air stream with phenolic resin protective coating.

2.8 VIBRATION ISOLATION

A. Mount the exhaust fan and motor on a common vibration isolation base selected for the fan frequency.
   1. Adjustable slide rail for belt tension adjustment.
   2. Housed adjustable springs.

B. Weatherproof all vibration isolation outdoors.
   1. Hot dipped galvanize steel parts.
   2. Zinc plated bolts.
   3. Zinc plate and neoprene coat all springs.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Installation as per manufacturer's recommendations.

END OF SECTION

SECTION 23 36 16

VARIABLE VOLUME TERMINAL UNITS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install variable volume terminal units, including hangers, controls and other required elements.
   1. Provide series flow fan powered variable volume terminal units where indicated on the drawings.

1.2 RELATED WORK

A. Division 23 Mechanical.
   1. Ductwork.
   2. Air Balance.
   3. Electrical Requirements for Mechanical Work.
   4. Building Management and Control System.
   5. Vibration Isolation.

1.3 COOPERATION WITH OTHER TRADES

A. Coordinate this work with work under Division 26 Electrical, to ensure that intended functions of lighting and air systems are achieved.

B. Coordinate the primary (input) voltage with the electrical power source. Refer to the Electrical Drawings for specific requirements.

1.4 SUBMITTALS

A. Submit product data for control devices, terminal boxes, and similar equipment for review prior to placement of purchase order. Submit internal wiring diagrams, installation and operation manual as a complete submittal package.

B. Submit certified sound power levels for both discharge sound and casing radiated sound in accordance with ARI 880-98 Certification Program. All NC levels shall be calculated using ARI 885-98, Appendix E attenuation factors for mineral ceiling.

C. Submit for each box the following information:
   1. Box size
   2. Inlet size
   3. Box number
   4. Box designation
   5. Minimum / Maximum Fan CFM
   6. L / R Coil connection
   7. GPM
   8. Motor HP
   9. NC Level
   10. External Static Pressure
   11. Scheduled MBH
   12. Actual MBH
   13. Heating Coil Pressure Drop (ft.)
   14. Entering and Leaving Water Temperature

15. Entering and Leaving Air Temperature

1.5 QUALITY ASSURANCE

A. Make air flow tests and sound level measurements in accordance with applicable ASHRAE Standards 130-96 and ARI 880-98.

B. Manufacturer shall certify cataloged performance and ensure correct application of terminal units.

C. Sound power levels to occupied space shall not exceed NC-30 as calculated using ARI 885-98 Appendix E attenuation factors for mineral tile ceiling.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Titus.

B. Krueger

C. Price

D. Nailor

E. Metalaire

2.2 BOX CONSTRUCTION

A. Galvanized 20 gauge steel casing with suspension lugs.

B. Lined with minimum 1.5 PCF / 1" thick fiber free
1. Flame spread not higher than 25.
2. Smoke developed rating not higher than 50.
3. Condensation on the exterior of the box is not approved.
4. Coat all cut edges of liner with NFPA approved sealant.
5. Lining shall pass UL 181, NFPA 90A and ASTM C 665.

C. Provide access to controls, fan compartment, and unit servicing, without disturbing duct connections. Limit the size of access doors to 24 inches. Where required, provide multiple access doors. Gasket each door in the unit casing.

D. Components shall be constructed of corrosion resistant materials.

E. Bearings shall not require lubrication.

F. Casing leakage shall not exceed 2.0% of scheduled design air flow at 3.0” WG interior casing pressure.

G. Seal casing joints with approved adhesive if required to meet the maximum casing leakage rate.

H. The maximum overall height of the variable air volume unit shall not exceed available ceiling space.

I. Maximum static pressure drop of air through terminal box shall be 0.2” w.g.

J. Maximum velocity through duct inlet shall be 2,000 fpm.

K. Terminal unit shall be provided with access to the entering side of the coil for coil cleaning.

2.3 COMPONENTS

A. The entire terminal unit, including the heating coil, shall be designed and built as a single unit.

B. Provide each unit with a primary variable air volume damper that controls the air quantity in response to a space sensor or building management and control system.

C. Each unit shall contain:
1. Fan and motor assembly. For Fan Powered Units Only
2. Heating coil.

D. Locate the heating coil in the discharge of the blower section.

E. Provide single point electrical connections for the entire unit. Entire assembly shall be UL or ETL Certified, electrical components shall be UL listed and installed in accordance with the National Electrical Code.

F. The variable air volume units provided by the manufacturer shall be the quietest design available from the manufacturer for the type specified.

G. Induced air filter frame for 1” thick disposable filter. The filter shall be sized to match the district filter sizes. Where the standard size is not available the manufacturer shall provide an adapter kit to allow the district standard sizes to be utilized. The details of this kit shall be submitted in the submittal package.

H. Sufficient power for the VAV unit DDC controller, electric actuator and other components necessary to satisfy the sequence of operation. Size each transformer for the total connected load plus an additional 25% of the connected load. Primary and secondary fuses housed in a fuse block.

I. Inlet attenuator for induction airside of box with liner to lower radiated noise.

2.4 BLOWER FAN AND MOTOR

A. Blower fan:
1. Constructed of steel.
2. Forward curved centrifugal wheel.
3. Dynamically balanced wheels.
4. Direct drive motors.

B. Motor
1. Ultra-high efficiency ECM motor technology

C. Motor current characteristics as scheduled. Coordinate motor voltage with Division 26. Verify voltage with Electrical Plans.
1. Thermal overload protection.
2. Sleeve bearings.

D. Provide isolation between fan motor assembly and unit casing.

E. Provide a manual speed control system to allow continuously adjustable fan speed from maximum to minimum.
   1. Electronic speed control matched to operate with the motor.
   2. Speed controller shall incorporate a minimum voltage stop to ensure motor cannot operate in a stall mode.

F. Fan disconnect switch. This is not to be used as a main disconnect switch.

G. Provide electric heating models with the following items:
   1. Single point electrical connection
   2. Line side disconnect switch
   3. Motor fuse
   4. Motor disconnect switch
   5. Fan SCR and relay
   6. Control transformer
   7. Air flow switch
   8. Heat contactors
   9. Thermal Hi-Limit Auto Reset switch

2.5 PRIMARY AIR DAMPER AND ACTUATOR

A. The control actuator shall vary the primary air damper in response to the control signal.
   1. Damper leakage at shutoff shall not exceed 2.0% at 1" WG pressure.
   2. Locate the damper inside the unit.
   3. Damper connection to the operating shaft shall be a positive mechanical connection.
   4. Damper shall have bearings at all penetrations of inlet tube and terminal housing. Penetration of damper shaft in terminal lining shall have seal at surface of lining to prevent fiber entrainment through rotation of damper shaft.
   5. Two damper stop pins shall be provided. One pin shall ensure damper cannot rotate beyond full closed position. One pin shall ensure damper cannot rotate beyond full open position.
   6. Inlet tube shall have rolled bead (outward position) prior to penetration point of flow sensor tubing to provide stop point for hard duct and anchor point for flex duct.
   7. Flow sensor tubing shall have gaskets at penetration point of inlet tube.
   8. Flow sensor shall be center averaging type. Non-center averaging flow sensors are not acceptable.

2.6 AIR FLOW CONTROL

A. Provide a flow control device that will limit the maximum CFM of the unit to that scheduled on the drawings.
   1. Air quantity shall be factory set.
   2. Thermostat signal shall reset the flow control device to reduce primary air quantity to match load requirements.
   3. Control shall be pressure independent.
   4. Each terminal shall incorporate a flow cross sensor with pick-up points connected to a center averaging chamber to ensure the following performance:
      a. Controller fidelity shall be +/-5% of set volume with a flex inlet

configuration and inlet static variation of 0.5" WG to 6.0" WG.

5. Provide flow measuring taps and a flow chart with each unit for field balancing air flow.

B. Hot Water Heating Coils:
   1. Provide hot water heating coils sized as scheduled.
      a. The hot water heating coil is specified to be provided and mounted under the work of this Section.
      b. Coil access door upstream of coil. Provide metal transition section from CVB to heating coil and provide access door in transition.
      c. Install coil with supply inlet at bottom and on leaving airside of coil.
      d. Maximum static pressure drop of water through heating coil shall not exceed 10’ w.g.
      e. Maximum static pressure drop of air through heating coil shall not exceed 0.25” esp

PART 3 - EXECUTION

3.1 INSTALLATION

A. Deliver and store products in a clean and dry place. Protect products from the weather, dirt, dust, construction debris and physical damage.

B. Install each unit in accordance with the manufacturer's printed installation instructions.

C. Suspend each unit from 1/4" electroplated zinc thread rods secured from structure.
   1. Provide sub-structure where required.
   2. Mount bottom of terminal unit no more than 18" above the finish ceiling height.
   3. Install units so that they are level and plumb.

D. Install a straight length of rigid ductwork upstream of all boxes. Provide at least 3 primary air inlet diameters of straight ductwork upstream of the primary air inlet connections. Flexible duct connections at boxes are allowed but are not a substitute for the straight run of rigid duct. A maximum of 4' of flexible duct is allowed at each box. All changes in direction shall be made with rigid duct. Seal connection at box, as required to comply with system maximum allowable leakage.

E. Coordinate the location of each variable air volume unit to ensure proper clearance so that all components are accessible and not blocked by other trades. Provide no less than the code required clearances to electrical components.

F. Cover and seal the openings of the VAV inlets during construction to prevent the inside from getting dirty. Where VAV units are considered dirty, as determined by the Architect / Engineer / Owner, clean the VAV units with a vacuum machine, and then wipe all surfaces with a cleaning agent, using clean rags.

G. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

H. All installation shall be in accordance with manufacturer’s published recommendations.

I. Provide clearance for inspection, repair, replacement and service. Ensure accessibility to all terminal unit electrical control panel doors, controllers and operators are located

a minimum of 30 inches from all obstructions (walls, pipe, etc.).

J. Provide ceiling access doors or locate units above easily removable ceiling components.

K. Support units individually from structure. Do not support for adjacent ductwork. Terminal units shall be supported using unit's hanger brackets and threaded rods.

L. Provide a duct access door on the leaving side of the heating coil for coil cleaning. Access shall be position within 6" of leaving side of heating coil.

3.2 MISCELLANEOUS CONTROLS

A. The following equipment items are to be furnished by Building Management and Control System and installed by Terminal Unit manufacturer:
   1. Automatic temperature control card (DDC).
   2. Damper actuator.

B. The following equipment items are to be furnished and installed by the Terminal Unit manufacturer:
   1. Damper.
   2. Multi-point flow sensor.
   3. Controller enclosure.
   4. Power transformer.

C. Coordinate the output voltage required by the Building Management and Control System.

D. Coordinate location of controller enclosure.

3.3 ACOUSTICAL PERFORMANCE TEST

A. Test each size for each type of variable air volume unit furnished on the project.

B. Test for radiated noise and discharge noise in all operational modes from minimum to maximum primary air settings; at inlet air pressures of 1 and 2 inches water column, and at primary air settings of 20, 40, 60 and 100 percent.

C. Testing shall be done by an independent testing laboratory. Sound values submitted shall be certified by the laboratory doing the testing. Testing laboratory must be approved by Engineer. Final testing and approval must be witnessed by Engineer.

D. Testing procedures shall be in accordance with ASHRAE Standard 130-96 and rated in accordance with ARI 880.

E. Test the unit complete with damper, coils and controls. The unit shall be operational and represent a final version of the units to be installed on the project.

F. If the units do not meet sound criteria, modify the units and retest at no additional cost to the Owner until the sound criteria is in accordance with Contract Documents. The variable air volume unit manufacturer shall be held liable for the costs associated with construction delays resulting from failed test, not to exceed the purchase order cost.

G. Sound Levels: Maximum sound power levels resulting from any box shall not exceed the following:

OCTAVE BAND CENTER FREQUENCY, Hz.						
	125	250	500	1000	2000	4000
Radiated SPL db	52	45	40	36	34	33
Discharge SPL db	44	37	31	27	24	22

1. Sound power levels are referenced to 10-12 watts.
2. Box inlet static pressure = 1-1/2”
3. No discounting for roof effect, ceiling attenuation, lined duct, division of flow and other similar effects.

3.4 SPARE PARTS

A. Provide one spare motor for each size box.

END OF SECTION

SECTION 23 37 13

AIR DEVICES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install air distribution devices, including grilles, diffusers, registers, dampers, and extractors.

1.2 RELATED WORK

A. Division 23 Mechanical.
   1. Ductwork.
   2. Air Balance.
   3. Electrical Requirements for Mechanical Work.

1.3 COOPERATION WITH OTHER TRADES

A. Coordinate this work with work under Division 26 Electrical, to ensure that intended functions of lighting and air systems are achieved.

1.4 SUBMITTALS

A. Submit product data for outlets, grilles, registers, control devices, and similar equipment for review prior to placement of purchase order.

B. Submittal shall include performance sheet for each air device type. Performance sheet shall include NC levels, throw, and total pressure loss at various air flows.

1.5 FINISHES

A. Paint exposed devices with factory standard prime coat, or factory finish coat, as specified.

PART 2 - PRODUCTS

2.1 DIFFUSERS, GRILLES AND REGISTERS - Refer to Drawing Schedule.

A. Perforated grilles shall not be used for supply air, return air or exhaust air.

B. Stamped face, Egg Crate (of any material) or door grilles shall not be used.

B. Acceptable Grilles and Diffusers:
   1. Supply Air Diffusers/Grilles
      a. Lay-in Square Cone, Steel or Aluminum, 360° pattern
      b. Lay-in Square Plaque, Steel or Aluminum, 360° pattern
      c. Surface Mount Square Louver Face, Steel or Aluminum, 360° pattern
      d. Round Cone, Steel or Aluminum, Steel or Aluminum, 360° pattern
      e. T-Bar Slot, Steel or Aluminum
      f. Double Deflection (Sidewall), Steel or Aluminum
   2. Return Air Grilles
      a. Louvered face, Steel or Aluminum, 45° deflection, 3/4" blade spacing Surface or lay-in type

2.2 ACCEPTABLE MANUFACTURERS

A. Titus.

B. Krueger.

C. Nailor Industries.

D. Metalaire

E. Price

2.3 ACCESSORIES

A. Supply Grille Extractors. Provide supply grilles with an air control device capable of positively regulating the volume of air extracted from the supply duct. Select extractors similar to Titus Model AG25, tight-closing in the minimum position. Include a key-operated or worm-gear adjusting mechanism to facilitate positioning from the grille opening. Where adjustment is not accessible at the grille opening, provide a square control rod equipped with a locking quadrant.

B. Mounting Frames. Provide each grille or register not equipped with a removable core with a companion, all-purpose mounting frame constructed like grille frame to facilitate installation and removal of the grille or register without marring adjacent mounting surfaces.
   1. Furnish frames with 1/2" thick sponge rubber gasket to prevent air leakage.
   2. Provide a frame that neatly fits the grille. Mounting frames will not be required for grilles or registers mounted directly on exposed ductwork.

PART 3 - EXECUTION

3.1 INSPECTION

A. Do not install ceilings adjacent to fixtures until installation of fixtures, air supply assemblies, return-air blank-off strips and flexible duct have been approved. Remove and reinstall any part of the installation found incorrect.

3.2 INSTALLATION

A. Louvered diffuser outlets mount tight against the ceiling. Fasten outlets to ductwork with sheet metal screws.

END OF SECTION

SECTION 23 41 00

AIR FILTRATION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install air filters.

1.2 RELATED WORK

A. Division 23 Mechanical.

1.3 SUBMITTALS

A. Submit manufacturer's product data sheets and capacity information as specified.

B. Submit recommended Dirty Filter pressure drop.

PART 2 - PRODUCTS

2.1 MEDIUM EFFICIENCY AIR FILTERS

A. The filter cells:
   1. Pleated media.
   2. Disposable type.
   3. Contain not less than 4.6 sq. ft. of filtering media per square foot of face area.
   4. 18 pleats per linear foot of filter.
   5. 2" thick.

B. Media of reinforced nonwoven cotton fabric treated with adhesive and continuously laminated to a supporting steel wire grid conforming to the configuration of the pleats.
   1. Seal the media pack in a water resistant cardboard frame.

C. Rated average dust spot efficiency of not less than 80%.
   1. Average synthetic arrestance in excess of 98% when tested in accordance with the ASHRAE 52-68 test standard.

D. Filter capable of operating with variable face velocities up to 500 fpm without impairing efficiency.

E. Initial resistance to air flow:
   1. 500 fpm - 0.41" WG.

F. UL listed with Class II rating.

G. Air Filter Inc. Astro-Pleat MERV 13 minimum

H. Provide one spare set for a complete change, in original cartons, for Owner's use during the warranty period.

I. Standard sizes 16x20x2, 16x25x2, 20x20x2, 20x25x2 only. If 1” filters are only option for equipment, sizes must be standard sizes as listed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install the filters in accordance with the manufacturer's instructions.

END OF SECTION

SECTION 23 65 27

AIR-COOLED ROTARY SCROLL CHILLER

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and Install a packaged, electric-driven, air-cooled, water chilling unit with multiple scroll compressors complete with controls.

1.2 RELATED WORK

A. Division 23 - Mechanical
   1. Chilled Water Piping
   2. Insulation
   3. Building Management Control System
   4. Vibration Isolation
   5. Electrical Provisions of Mechanical Work

1.3 REFERENCES

A. ANSI/ARI 550/590 - Water Chilling Packages using the Vapor Compression Cycle.
B. ANSI/ASHRAE 15 - Safety Code for Mechanical Refrigeration.
C. ANSI/ASHRAE 90A - Energy Conservation in New Building Design.
D. ANSI/ASME SEC 8 - Boiler and Pressure Vessel Code
E. ANSI/NEMA MG 1 - Motors and Generators.
F. ANSI/UL 465 - Central Cooling Air Conditioners.
G. ANSI/AFBMA 9-1978 - Load Ratings and Fatigue Life for Ball Bearings. Bearings must have life of not less than 200,000 hours.
H. ANSI/NFPA Standard 70 - National Electrical Code (NEC)
I. ASTM B117 - Standard Method of Salt Spray (Fog) Testing
J. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
K. ASTM A525 - Zinc (Hot-Dip Galvanized) Coatings on Sheet Steel Products
L. ASTM D1654 - Evaluation of Painted or Coated Specimens, Subjected to Corrosive Environments.

1.4 PERFORMANCE

A. Provide performance as scheduled on drawings. Provide factory run test to ensure proper chiller operation. Provide certified documentation to Owner in Closeout Documents.

1.5 WARRANTY

A. The Chiller manufacturer shall provide a full machine parts, labor, and refrigerant warranty for a period of five (5) years from substantial completion.
   1. The warranty shall include, but not be limited to the compressor assemblies including motor, condensers, fans, variable frequency drives, controls, evaporator, condenser, refrigeration system and all other auxiliary components and accessories as well as refrigerant and oils in systems.
   2. In the event of failure, provide new or factory authorized rebuilt parts. Shop or job site rebuilt parts are not acceptable.
   3. On all manufacturers warranties the chiller manufacturer shall provide a factory certificate listing as a minimum chiller model, serial, and warranty information as specified above. Each chiller tag shall be provided with an individual and

unique warranty certificate. Manufacturer's representative warranty letters are not acceptable as an alternative to the original manufacturer's certificates.

4. The chiller manufacturer authorized service agency is required to perform any and all warranty service. Contractor warranty service is not authorized. Warranty work shall be performed with District Representative present.

1.6 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 evaporator (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 evaporator (annually)
n. Clean the evaporator flow sensor (annually)

1.7 SUBMITTALS

A. Submit manufacturer's certified computer generated performance and capacity data in accordance with specification requirements.

B. Submit the following information:

1. Manufacturer's installation instructions.
2. Minimum Circuit Ampacity.
3. Maximum Overcurrent Protection size.
4. Maximum conductor / Terminal Lug size.
5. Minimum flow thru evaporator.
6. Electrical interlocks.
7. AHRI Chiller Efficiency values at 100%, 75%, 50% and 25%

C. Submit recommended clearance dimensions for air flow and service.

D. Submit coordination drawings as specified.

1. Give consideration to adjacent structures as they affect air flow patterns.

E. Submit internal wiring diagram of Control Center.

F. Submit sequence of operation in narrative form.

G. Submit a letter stating chiller being proposed meets the efficiency requirements of Centerpoint Energy's Score Program listed in Centerpoint Energy's Design Guide: HVAC Recommendations document.

G. Mark-up a copy of the specifications, indicating in the margin of each paragraph, the following: COMPLY, DO NOT COMPLY, NOT APPLICABLE.

1.8 STORAGE/HANDLING/SHIPPING

A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

B. Protect units from physical damage. Factory coil shipping covers shall be kept in place until installation.

C. Unit controls shall be capable of withstanding 203°F (95°C) storage temperatures in the control compartment for an indefinite period of time.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Carrier

B. Daikin

C. Trane

2.2 COMPRESSORS

A. Provide a minimum of two independently circuited hermetic rotary scroll type compressors with the following:
   1. Direct drive, 3600 rpm, suction gas-cooled hermetic motor.
   2. Rubber isolation pads.
   3. Crankcase heaters.
   4. Oil sight glass.
   5. Load and unload solenoid valves.
   6. Discharge oil separator.
   7. Hot gas bypass for compressor unloading.
   8. Centrifugal oil pump.
   9. Oil charging valve.

B. Provide capacity modulation from 100% to 25% via compressor cycling.
   1. Control to be based upon leaving chilled water.
   2. To avoid excessive compressor cycling while maintaining leaving chilled water temperature at desired temperature +/- differential, compressor cycling set points to be separated by a minimum 20% capacity dead band.

C. Ultra-Low Sound Compressor Control: Chiller manufacturer shall provide the following attenuation package and meet scheduled maximum A-weighted sound pressure level rating of 70dBA at 30’ from the condenser coil side of chiller per AHRI. Complete sound attenuation package shall be provided regardless if scheduled dBA is met without.
   1. Provide ultra-low sound blanket on a minimum of 100% coverage of each compressor, suction line, discharge line and oil separator.
   2. Removable Sound Covers shall be constructed with a Silicone-fiberglass cloth outer jacket, a loaded vinyl barrier septum, fiberglass needle mat (11 lbs./ft.3 density), and a Silicone-fiberglass cloth inner jacket. The covers shall be connected together by means of a cloth straps with “D” rings and Velcro fasteners. The inner and outer jackets shall protect against UV rays, oil and water. Finished

Surface Mass – 3 lbs. per sq. ft., to cover compressors and extended components for the specified chiller. Stainless steel wire tie fastening assemblies are not acceptable.

3. Provide detailed ultra-low sound acoustical data with submittal. Data shall include sound pressure rating across each octave band and A-weighted average for chiller as built with attenuation package.

2.3 CONDENSER COILS

A. Coil shall be microchannel design and shall have a series of flat tubes containing multiple, parallel flow microchannel layered between the refrigerant manifolds. Tubes shall be 9153 aluminum alloy. Tubes made of 3102 alloy or other alloys of lower corrosion resistance shall not be accepted. Long Life Alloy Microchannel shall pass 4500hr salt spray rating uncoated.

B. Protect all vertical or angled coil sections from hail or physical damage with corrosion resistant louvered hail guard including chiller ends, factory installed to cover compressor and condenser sections.

C. Field adjustable head pressure based fan cycling controls for each circuit capable of maintaining minimum head pressure down to 20°F unless noted otherwise.

D. Protect condenser coils during shipping.

E. Provide condenser coils coated with corrosion resistant epoxy utilizing a dip and bake. Coating shall be flexible and uniformly bonded to all condenser coil surfaces.

2.4 FANS AND MOTORS

A. Direct Drive Ultra Low Sound propeller type fans.
   1. Vertical discharge with sound reduction without performance reduction.
   2. Protect fan blades with a heavy-gauge wire guard.
   3. Statically and dynamically balanced.
   4. Sound reduction engineered heavy-duty molded plastic blades designed to reduce airflow turbulence.

B. Motors with built in thermal overload protection
   1. Permanently lubricated ball bearings.
   2. Weatherproof (TEAO or TEFC) motors.

2.5 COOLER/EVAPORATOR

A. Provide brazed plate and frame direct expansion cooler with:
   1. Copper and stainless steel construction
   2. 150 psig water side working pressure
   3. ASME coded 430 psig refrigerant side working pressure
   4. Fully independent refrigerant circuit for each compressor.
   5. Serviceable construction including removable heads and field replaceable tubes.
   6. Drain and vent connection.
   7. Inline strainer on chiller inlet.

B. Protect cooler with ambient controlled heater cable and minimum 1-1/4" thick flexible elastomeric rubber closed cell insulation. Heater cable to protect evaporator to -20°F (-29°C). Heater cable shall be wrapped helically around the shell under the insulation.

C. Protect insulation and equipment from abrasion by unit enclosure.

D. After completion of successful start-up, installing contractor shall seal all openings.

E. Provide water drain connection, vent and fittings for factory installed leaving water temperature control and low temperature cutout sensors.

F. Water connections shall be grooved or flanged.

2.6 CASING/ENCLOSURES

A. House components in minimum 14 gauge galvanized steel frame and mounted on welded structural steel base. Hot-dip galvanized steel frame coating shall be Underwriters Laboratories Inc. (UL) recognized as G90-U, UL guide number DTHW2.

B. Unit panels, and control panels shall be 14 gauge, finished with a baked on powder paint. Control panel doors shall have door stays. Paint system shall meet the requirements for outdoor equipment of Federal Government Agencies.

C. Mount starters and disconnects in weatherproof panel provided with full opening access doors. Provide lockable disconnect operating handle external to panel and clearly visible from outside of unit indicating if power is on or off.

D. Casings fabricated from steel that do not have a Zinc coating conforming to ASTM A 123 or ASTM A525 shall be treated for the prevention of corrosion with a factory coating or paint system. The coating or paint system shall withstand 672 hours in a salt-spray fog test in accordance with ASTM B 117. Each specimen shall have a standard scribe mark as defined in ASTM D 1654. Upon completion of exposure, the coating or paint system shall be evaluated and rated in accordance with procedures A and B of ASTM D 1654. The rating of failure at the scribe mark shall be not less than six (average creepage not greater than 1/8"). The rating of the unscribed area shall not be less than ten (no failure). Thickness of coating or paint system on the actual equipment shall be identical to that on the test specimens with respect to materials, conditions of application, and dry-film thickness.

2.7 REFRIGERANT CIRCUIT

A. All units shall have a separate independent refrigerant circuit for each compressor. Twenty & 30 Ton single circuit; 40, 50 & 60 Tons, dual individual refrigerant circuits.

B. Provide for each refrigerant circuit:
1. Liquid line isolation valve.
2. Filter dryer (replaceable core type).
3. Liquid line sight glass and moisture indicator.
4. Electronic or thermal expansion valve sized for maximum operating pressure. Expansion valves with less than five years of proven field operation are not acceptable.
5. Charging valve.
6. Discharge and oil line check valves.
7. Compressor suction and discharge service valves.
8. Relief valve.
9. Full operating charge of refrigerant and oil.
10. Unit factory leak tested at 200 psig.
11. Provide refrigerant not schedule for phase out.

2.8 CONTROL PANEL

A. The Control Center.
   1. NEMA 3R weatherproof cabinet with hinged lockable outer door.
   2. Control system.
   3. Solid-state compressor three phase motor protection.
   4. Single point field power connection points.
   5. Control interlock terminals.
   6. Fan motor and control circuit fuses.
   7. Individual contactors for each fan motor.
   8. Unit power terminal blocks for connection to remove disconnect switch.
   9. Power supply terminals for evaporator heater circuit.
   10. Dead front panels over line voltage.
   11. Control power / circuit transformer.
   12. Provide incoming power terminals, sized to accept the feeder conductors.
   13. Chiller run and alarm status relay cards.

B. Microprocessor control system.
   1. Stage unit based on leaving water temperature control.
   2. Oil differential pressure setpoints.
   3. Motor protection.
   4. High pressure alarm.
   5. Loss of refrigerant alarm.
   6. Loss of water flow alarm.
   7. Freeze protection alarm.
   8. Low refrigerant pressure alarm.
   9. Auto start/stop switch.
   10. Chilled water setpoint adjustment.
   11. Anti-recycle timer.
   12. Compressor run status.
   13. Password protection.
   14. Low water temperature safety (freeze protection).
   15. Automatic pump down cycle.
   16. Limit supply water temperature pull down on start up to 1° per minute.
   17. Automatic lead-lag sequence change of compressors.
   18. Unload the compressors if the return water is too high.
   19. Compressor starts with the controlled cylinders unloaded.
   20. Reset of the chilled water temperature.
   21. Indicate status of safeties.
   22. Non-volatile memory (EPROM) with setpoints retained with battery backup.
   23. Automatic high pressure unloader to unload compressor at pressures above 375 psig.
   24. Auto restart after power failure.
   25. BacNET interface
   26. Alarm Relay
   27. Percent of Running Load Amperage

C. Display the following information with 16 key keypad with two line x 40 character clear English Display for outdoor viewing.
   1. Supply and Return water temperature.
   2. Low water temperature cutout setting.
   3. Low ambient temperature cutout setting.
   4. Outdoor air temperature.
   5. English and Metric data.
   6. Suction pressure cutout setting.

7. Each system suction pressure.
8. Each system discharge pressure.
9. Each system oil pressure.
10. Percent of full load motor current.
11. Liquid control range. (2.0 - 20°F above setpoint).
12. Liquid pulldown rate sensitivity adjustment.
13. Anti-recycle timer status for each compressor.
12. Compressor starts & operating run hours.
13. Safety shutdown shall be date and time stamped.
14. Compressor run status.
15. History and alarm diagnostic memory display.

D. All control functions and information shall be available at the unit control panel or via RS 232 cable and phone modem to personal computer.

E. Chiller shall include a relay board with dry contacts for alarms to notify a Building Automation System of certain events or states of the chiller.

F. Chiller shall include input for leaving chilled water temperature setpoint based upon a 2-10VDC or 4-20mA signal from a Building Automation System.

G. Chiller shall include input for chiller current limit setpoint based upon a 2-10VDC or 4-20mA signal from a Building Automation System.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install system in accordance with manufacturer's instructions.

B. Align chiller package on concrete footings as detailed on the drawings.12” minimum height.

C. Locate away from overhead restrictions. Maintain side clearances according to manufacturer's recommendations and maintain overhead clearance to allow full elimination of hot air discharge.

D. Install units on vibration isolation pads.

E. Arrange piping for easy dismantling to permit tube cleaning, removing and or repair.

F. Level chiller.

G. Install all electrical and control conduit into the bottom only of electrical cabinet. (No top or side cabinet penetrations)

3.2 CHILLER MANUFACTURER START-UP/ FIELD SERVICES

A. Provide the services of a factory trained service technician employed full time by the chiller manufacturer to start-up the system. Technicians, as required, shall be factory trained and experienced in the work they perform. (Contractor startup is unacceptable.)

B. The technicians shall utilize comprehensive report forms to document results. Sample forms shall be submitted for review prior to commencing work.

C. Upon completion of the work, the report forms shall be signed by the technicians and their

supervisor and included in the final report and Owner's manual.

D. Submit four copies of the final report to the Architect/Engineer for approval within 10 working days of start-up.

E. Follow the manufacturer's start-up procedures.
1. Verify interlocks.
2. Test and verify operation of safety controls.
3. Calibrate controls.
4. Verify microprocessor based control operation.
5. Test, calibrate, and set the chilled water temperature controls.
6. Verify chilled water temperature reset sequence.
7. Verify operation of the integrated control panel.

F. Measure and record the following data:
1. Chilled water entering/leaving temperature.
2. Chilled water flow through the chiller.
3. Suction pressure/condensing pressure.
4. Suction pressure/unloading steps.
5. Air entering/leaving condenser; dry bulb temperature.
6. Outdoor ambient; dry bulb.
7. Motor nameplate voltage; phase and full load amperes.
8. Heater coil in starter (as applicable)
    a. Rating in amperes.
    b. Manufacturer's recommendation.
9. Power reading (voltage and amperes of legs at motor terminals).

G. Test and calibrate the operation of the electronic ground current sensing devices.

H. If the system has been shipped with a holding charge, provide the following:
1. Leak test.
2. Refrigerant pressure test.
3. Evacuate, dehydrate and charge.

I. Verify that accessories are installed and performing the specified functions. Insert certification in Owner's manual.

J. Instruct the Owner's operating personnel. Provide Owner with 8 hours of training prior to substantial completion.

K. Do not operate the equipment for any reason until the factory start-up service has been completed and before all closed loop water treatment system is active.

L. Provide a print-out from the unit micro-computer control system showing the correct operation of all system controls and components.

M. Provide minimum 24 hour history log displaying accuracy of temperature control system in 15 minute intervals and documented number of compressor cycles during the 24 hour period.

N. Remove construction screen from strainer at plate and frame heat exchanger, flush strainer, repair insulation at heat exchanger to like new condition and temporarily attach screen to chiller for inspection by owner and engineer.

END OF SECTION

SECTION 23 73 13

AIR HANDLING UNITS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install air handling units with casing, fans, coils, filters and special items.

1.2 RELATED WORK

A. Division 23 Mechanical
   1. Air Balance
   2. Ductwork
   3. Controls
   4. Electrical Provisions of Mechanical Work
   5. Air Filtration
   6. Heating and Cooling Coils
   7. Other applicable sections

1.3 PERFORMANCE

A. Unit capacities and characteristics as indicated.
   1. Units must be certified in accordance with ARI Standard 430-66.
   2. UL 1995 certification for safety including electric heat.
   3. ARI 430 listed and meet NFPA 90A requirements.

1.4 SHOP DRAWINGS

A. Indicate assembly, unit dimensions, weight loading required clearances, construction details, field connection details, and electrical characteristics and connection requirements.

B. Submit fan performance curve for each unit:
   1. Plot fan volume against static pressure, horsepower and efficiency.
   2. Show point of rating based on static requirements of the system.
   3. Chart of specific sound power level at each octave band center frequency.
   4. For variable volume units, plot fan volume over entire range.

C. Submit for review a unit internal static pressure loss calculation.
   1. Provide an itemized list of static pressure loss at the scheduled CFM for each unit component including and not limited to:
      a. Coils
      b. Dirty filters
      c. Fan and unit system effect
      d. Cabinet and cabinet inlet and outlet
      e. Unit mounted dampers
   2. If a unit mounted outside air pretreatment section without supply fan, “piggyback” is specified:
      a. Provide an itemized static pressure loss as indicated above.
      b. Determine losses for unit configuration, i.e. parallel or series.
      c. Include losses in the primary unit internal static pressure required by configuration.
   3. The air handling unit schedule indicates static pressure external to the unit

and does not include any losses associated with the air handling equipment.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, condensate properly tapped, piping connections verified and leak tested, belts aligned and tensioned, all shipping braces have been removed, and fan has been tested under observation.

1.6 DELIVERY, STORAGE AND HANDLING

A. Inspect for transportation damage and store in a clean, dry location. Protect from weather and construction traffic.

B. Manufacturer shall provide quick shipment options to minimize product lead times.

1.7 WARRANTY

A. The Air Handling Unit manufacturer shall provide a full machine parts and labor warranty for a period of one (1) year from substantial completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Carrier

B. Daikin

C. JCI

D. Temtrol

E. Thermal

F. Trane

2.2 MISCELLANEOUS REQUIREMENTS

A. Provide factory assembled units. Large units may be shipped in sections, at contractor's option, to enable entrance to building, or for oversize shipping reasons only.

B. Furnish units with sealing and fastening hardware supplied by the manufacturer. Include written instructions needed to complete field assembly of the components.

C. Provide units designed and constructed so that coils, panels, fan housing and fans can be removed without affecting the structural integrity of the unit.

D. Unit casing panels shall be double wall construction with solid galvanized exterior and solid galvanized interior. Panels shall have a minimum thermal resistance of R-13. The casing shall not exceed 0.0042 inch deflection per inch of panel span at 1.5 times the design static pressure up to a maximum of +8 inches in all positive pressure sections and -8 inches in all negative pressure sections.

E. Provide full perimeter base rail channel under units constructed of heavy gauge galvanized steel (minimum 10 gauge) and intermediate cross members to assure unit integrity. Provide minimum size base rail to ensure proper trapping and slope of condensate drain (minimum 6 inch from bottom of drain opening).

F. Fan assembly shall be provided with 1" deflection internally mounted spring vibration isolation under the fan and motor base on units with coils less than 8 sq. ft. and 2" deflection internally mounted spring vibration isolation under the fan and motor base with coils greater than 8 sq. Ft. Units with coils over 35 sq. ft. shall have spring thrust restraints securing the fan housing to the discharge opening panel on units. Fan motor shall be internally mounted. Provide internal flex connection of fan discharge. Maximum acceptable RPM of fan shall not exceed 1000.

G. Provide factory installed removable hinged access doors in the following locations:
1. Entering and leaving side of all coils to allow for cleaning of coils on both sides of unit.
2. Each side of filter compartment to allow changing of filters from either side.
3. Each side of motor compartment to allow motor and isolation access.
4. Each side of condensate drain pan to allow for cleaning and inspection.
5. Swing the doors against the casing static pressure.

H. Provide all coil modules, including heating coil modules, with stainless steel drain pans to facilitate cleaning and maintenance of the coils. Drain pan to extend 10” minimum downstream of cooling coil.

I. Provide coils with stainless steel casings, end plates, tube supports and top & bottom plates.

J. Units shall meet ASHRAE III Class 6 Low Leakage Standard. Casing shall have less than a 1% leakage rate at plus or minus 8 inches W.G.

2.3 DRAW THROUGH AIR HANDLING UNITS – VARIABLE AIR VOLUME

A. Provided with:
1. Non-Overloading direct drive plenum fans. Provide minimum number of fans as indicated on drawings.
2. Insulated sheet metal cabinet with removable panels for access to the interior.
3. Hinged double wall doors with two-step safety handles.

B. Drive assembly:
1. Sized for 50% overload.

C. Motors and Control:
1. Totally enclosed, fan cooled, Variable speed, 1750 rpm.
2. Maximum operating point of 70 Hz.
3. Minimum 90% nominal efficiency at loads of 70%-100%.
4. Premium efficiency inverter duty
5. NEMA B design, with Class B insulation, capable to operate continuously at 104 deg F without tripping overloads.
6. +/- 10% voltage utilization range to protect against voltage variation.
5. Cast iron frame and end plate
6. Forged steel lifting eye
7. Oversized conduit box with ground lug
8. Provide with factory installed shaft grounding rings by Aegis

9. Motor selected so that the brake horsepower required to deliver the design air quantity at the system static pressure will not exceed the motor nameplate rating.

D. Supply Fans:
1. Single width, single inlet, backward curved welded aluminum plenum fan.
2. Statically and dynamically balanced to a BV-3 per AMCA 204 test standard.
3. Tested after being installed in the fan sections.
4. Selected for the design air quantities and pressure of the system.
5. Mounted on a common shaft if multiple wheels.
6. The fan shall be rated in accordance with AMCA 210 for performance and AMCA 260 for sound.
7. Minimum of Class II fan.

E. Fans selected with isolation shall be internally isolated with spring isolators. A flexible connection shall be installed between fan and unit casing to ensure complete isolation. Flexible connection shall comply with NFPA 90A and UL 181 requirements. If fans and motors are not internally isolated, then the entire unit shall be externally isolated from the building, including supply and return duct work, piping, and electrical connections. External isolation shall be furnished by the installing contractor to avoid transmission of noise and vibration through the ductwork and building structure.

F. Each direct drive fan in a multiple-fan array shall be provided with integral back flow prevention: a backdraft damper that prohibits recirculation of air in the event a fan or multiple fans become disabled. Dampers are tested and rated based on AMCA Standard 500. Dampers to be heavy duty type capable of a maximum back pressure that exceeds the design total static pressure with minimal leakage. The dampers should have a minimal total effect on airflow performance; both pressure drop when open and system effect on the fan. The damper blades and frame shall be extruded aluminum with blade edge seals locked into the blade edge. Adhesive type seals are unacceptable. AHU manufacturer responsible for providing proper spacing upstream of dampers to ensure full, uniform airflow through upstream components. For units where the damper(s) are supplied at the jobsite, the installing contractor shall contract a certified TAB contractor to verify uniform airflow thru upstream components.

G. Select fan to operate at or near its maximum efficiency point when handling the required air quantity and static pressure.

H. Stainless steel condensate pan with positive slope in all directions to outlet. Line the condensate drain pan with minimum 1-1/2" waterproof insulation.

I. Insulation, vapor barriers, facings and adhesives shall have:
1. Flame spread not higher than 25.
2. Smoke developed rating not higher than 50.

J. Double wall casing construction. Construct interior casing panels with 3 lb. minimum density insulation for acoustical and condensation control.
1. Condensation on the exterior of the air handling units is not acceptable.

K. Filter section:
1. Constructed with substantial hinges.
2. Neoprene gasketing.
3. Permanent quick release latching devices.

4. Arranged to accommodate 2" thick filters as specified.
5. Filter rack shall be factory manufactured to accommodate the filter sizes listed below. Field alterations to filter section is unacceptable.
6. Low velocity angled filter section unless otherwise specified.
7. 16x20x2, 16x25x2, 20x20x2, 20x25x2 only.

L. Cooling coils as specified. Extend drain and vent piping through cabinets. Provide grommets at all pipe penetrations through cabinets.

M. Heating coils as specified. Extend drain and vent piping through cabinets. Provide grommets at all pipe penetrations through cabinets.

N. Provide units with factory fabricated mixing box section that include an additional 2” thick metal perforated inner liner which utilizes fiberglass insulation. Liner shall be installed on all walls and top surface.

O. Provide each fan section with an additional 2” think perforated metal inner liner which utilizes fiberglass insulation. Liner shall be installed on all walls and top surface.

P. Factory dynamic fan balancing shall be conducted from 16Hz to 60Hz to identify and eliminate critical speeds to ensure stable operation through the entire operating range of the fan and drive assembly. Field fan balancing is not acceptable. Forward factory balancing test report to Engineer upon request.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install air handling units according to manufacturer's instructions.

B. Provide additional drive packages as required by the Testing and Balancing firm.

C. Air leaks detectable by sound or touch are to be corrected.

D. Air handling units are to be properly supported to prevent flexing, bending or distorting base rails.

E. All coils and drain pans are to be cleaned prior to substantial completion if units are used during construction.

F. Clean all air handling units and return to original manufacturer's condition prior to substantial completion. Vacuum clean all debris from inside air handling equipment.

G. Install piping to unit with full size 6 inch long dirt leg with 1/2" valve at bottom for cleaning.

H. Provide for positive gravity drainage of coil condensate. Pipe full size of unit connection.

I. Adjust fan drives as required to obtain scheduled capacities as directed by the Test and Balance Firm to include sheave and belt replacement.

J. Align belts to eliminate wear and vibration of belts.

K. Verify correct drainage of condensate from condensate pan.

L. Verify correct rotation of fan and wiring of motor.

M. Lubricate all greaseable ball bearings with manufacturer's suggested lubricant.

N. Replace filters as required if units are used during construction.

O. Provide piping installation so that after piping is completed and insulated there is full access to service unit and remove fan housing. Piping to coils shall not block fan section access or cause damage to piping insulation during access.

P. AHU motors must be wired with Kernay connections inside motor terminal boxes. No wire nuts. Kernay connections must be wrapped with rubber and electrical tape for insulation.

3.2 IDENTIFICATION

A. Furnish each unit with a durable, deep etched, .025" thick, factory installed aluminum identification plate, permanently mounted with the following information:
1. Unit identification as indicated on Contract Drawings.
2. Serial Number.
3. Model Number.
4. Capacity (CFM) and static pressure.
5. Motor HP.
6. Unit power supply: Volts / PH / Amps.
7. Supply Fan Type.
8. Coil GPM and pressure drop.
9. Sales Order #.
10. Date unit manufactured.

END OF SECTION

SECTION 23 82 16

HEATING AND COOLING COILS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install heating and cooling coils.

1.2 SUBMITTALS

A. Submit manufacturer's product data sheets and unit capacity information as specified.

B. Submit manufacturer's Installation, Start-Up and Service Instructions.

C. Submit internal wiring diagram.
   1. Electrical interlocks. *

1.3 RELATED WORK

A. Division 23 Mechanical.
   1. Air Handling Units.
   2. Fan Coil Units.
   3. Weatherproof Roof Mounted Air Handling Units.
   4. Ductwork.
   5. Terminal Boxes.

PART 2 - PRODUCTS

2.1 HOT WATER COILS

A. Hot water coils:
   1. Constructed of copper tubes and aluminum fins.
   2. Designed and circuited for hot water.
      a. Maximum temperature 200°F.

B. Where coils are installed in fan powered VAV boxes, unit heaters and other locations the maximum approved fin spacing is 8 fins per inch.

C. Non-trapping circuit design:
   1. Working pressure 200 psi
   2. Tappings for drain and air vent

D. Provide a Peterson Pete's Plug with retainer strap on the inlet and outlet of each coil.
   1. Positioned to permit accurate pressure readings.

E. Coils shall be constructed in casings as required for installation.

F. Heating coils installed within ductwork or on the leaving side of a terminal unit shall be installed with a transition ductwork section to match the full face area of the heating coil. Provide an access door on both the entering and leaving sides of the duct mounted coil.

2.2 CHILLED WATER COILS

A. Chilled water coils:
   1. Constructed of copper tubes and aluminum fins
   2. Designed and circuited for chilled water
   3. Minimum of six rows

B. Non-trapping circuit design:
   1. Working pressure 200 psi.
   2. Tappings for drain and air vent.

C. Provide a Peterson Pete's Plug with retainer strap on the inlet and outlet of each coil. Position to permit accurate pressure readings.

D. Coils shall be constructed in casings as required for installation.

E. Where coils are stacked, provide intermediate drain pans with drop tubes to drain condensate to the main drain pan without flooding the lower coil.

2.3 DIRECT EXPANSION COOLING COILS

A. DX cooling coils:
   1. Constructed of copper tubes and aluminum fins.
   2. Designed and circuited for use with direct expansion refrigeration.

B. Cooling coil face velocity:
   1. Not of magnitude to cause moisture to be carried off the coil.
   2. Maximum velocity as scheduled.

C. Circuit cooling coil with interlaced tubes so the entire face is active under all modes of unloading. Refer to the schedule on the drawings.

D. Coils shall be constructed in casings as required for installation.

E. Where coils are stacked, provide intermediate drain pans with drop tubes to drain condensate to the main drain pan without flooding the lower coil.

2.4 ELECTRIC HEATERS

A. Capacity shall be as scheduled on the drawings. Heater shall have 80% nickel, 20% chromium, open resistance coils insulated by floating ceramic bushings, and be supported in an aluminum steel frame.

B. Ceramic bushings shall be recessed into embossed openings and staked into supporting brackets spaced 3-1/2" maximum center to center.

C. Coil shall be machine-crimped into threaded terminals and insulated with phenolic bushings. All terminal hardware shall be stainless steel.

D. Heater shall be listed by the Underwriters Laboratories for zero clearance to combustible surfaces and for use with central air conditioners.

E. For primary protection, furnish a disk-type automatic reset thermal cutout for pilot duty only.

F. For secondary protection, load-carrying manual reset thermal cutouts shall be wired in

series with each heater circuit. Cutouts shall be rated at 480 volts minimum.

G. Voltage, phase and number of heating stages shall be furnished in accordance with duct heater schedule. Three-phase heaters shall have single-phase circuits for operation from a 3-phase, 4-wire power source. Circuits shall be rated at 48 amperes maximum. Furnish one set of line terminals to feed all circuits. Heater shall be tested dielectrically at 2000 volts before shipment. Field-installed conductors feeding the heater shall be sized for 125% of the connected load.

H. Built-in components shall be factory wired to terminal blocks for field connection. All internal wiring shall be insulated for 105°C. Built-in magnetic contactors shall disconnect all ungrounded conductors to each circuit. Furnish heaters with an air flow switch that will not allow heaters to energize without proof of air flow. Built-in transformer shall be dry industrial type, sized to carry full contactor holding coil load. Primary windings shall be fused at the factory. Built-in fuses shall be factory wired to each circuit to protect all underground conductors. Type NON or NOS fuses to be factory installed in phenolic fuse blocks. Built-in disconnect switch to be snap action, industrial type. Provide a door interlock mechanism to prevent hinged terminal box cover from being opened when the switch is on. Switch shall be unfused.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install the duct heaters in accordance with the manufacturer's Installation, Start-Up and Service Instructions.

END OF SECTION

SECTION 23 82 18

DUCTLESS MINI SPLIT DX UNITS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install mini split system. Complete with a slim silhouette, compact, high wall fan coil section with a wired wall mounted thermostat and a slim silhouette horizontal discharge outdoor condensing unit. Unit shall be provided with inverter driven compressor, pre-charged with R410A or R32 refrigerant. air-cooled condensing units complete with casing, compressor, condenser coil, condenser fan and controls required for a split air conditioning system.

1.2 RELATED WORK

A. Refrigerant Piping.

B. Electrical Provisions of Mechanical Work.

1.3 PERFORMANCE

A. Provide performance as scheduled on drawings, and head pressure control to enable unit to operate in temperatures as low as 20 degrees F. ambient.

1.4 QUALITY ASSURANCE

A. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL) and bear the ETL label.

B. All wiring shall be in accordance with the National Electrical Code (N.E.C.).

C. The units shall be rated in accordance with Air-conditioning, Heating, and Refrigeration Institute's (AHRI) Standard 210 and bear the AHRI Certification label.

D. The units shall be manufactured in a facility registered to ISO 9001 Quality assurance Standards and ISO 14001 which are set of standards applying to sustainability and environmental protection set by the International Standard Organization (ISO).

E. A pressure charge of R410A or R32 refrigerant sufficient for up to twenty-five (25) feet of refrigerant tubing shall be provided in the outdoor condensing unit.

F. A dry air holding charge shall be provided in the indoor section.

1.5 WARRANTY

A. Unit shall have a manufacturer's parts and defects warranty for a period five (5) years from the date of the original installation. The compressor shall have a warranty of seven (7) years from date of installation. Warranties shall start at the date of substantial completion.

PART 2 - PRODUCTS

2.0 ACCEPTABLE MANUFACTURERS

A. Daikin

B. Trane - Mitsubishi

C. LG

2.1 INDOOR UNIT GENERAL

A. The indoor shall be factory assembled, wired and run tested. Contained within the unit cabinet shall be all factory wiring, internal piping, electronic control circuit board and fan with fan motor.

B. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and auto restart after power interruption function, an emergency operation function and a test run switch.

C. Indoor unit and refrigerant pipes shall be charged with dry air before shipment from the factory. All refrigerant piping must be insulated.

2.2 CABINET

A. The casing shall have a smooth front, top return, in a white finish.

B. Multi directional drain and refrigerant piping offering four (4) directions for refrigerant piping and two (2) directions for draining shall be standard.

C. There shall be a separate installation plate which secures the unit firmly to the wall. Secure mounting of plate and all mounting hardware shall be furnished by and be the responsibility of the installer.

2.3 FAN

A. The indoor unit fan shall be an assembly with a line-flow fan direct driven by a single motor mounted in rubber motor mount.

B. The fan shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings.

C. Manual adjustable vertical guide vanes shall be provided with the ability to change the airflow from side to side (left to right).

D. An integral, motorized, horizontal air sweep flow louver shall provide an automatic change in airflow by directing the air up and down to provide for uniform air distribution.

E. The indoor unit fan motor shall operate in four (4) selectable speeds, Powerful, High, Medium, and Low.

2.4 FILTER

A. Return air shall be filtered by means of easily removed, washable, Catechin air filter and an anti-allergy enzyme filter – blue bellows type.

2.5 COIL

A. The indoor unit (evaporator) coil shall be of nonferrous construction with smooth, pre-coated aluminum fins on copper tubing.

B. Tubing shall have inner groves for high efficiency heat exchange.

C. All tube joints shall be brazed with PhosCopper or silver alloy.

D. The coil shall be pressure tested at the factory.

E. A sloped condensate pan and drain shall be provided under the coil. Drain connections shall be provided at each end of the drain pan. A condensate mini-pump shall be provided to provide a means of condensate disposal when a gravity drain is not available.

2.6 ELECTRICAL

A. Power for the indoor unit shall be supplied from the outdoor unit.

B. Power supply shall be as indicated on the drawings.

C. The unit shall be equipped with a micro-processor control system directing indoor and outdoor unit coordinated operation.

D. The indoor unit shall not have any supplemental electrical heat elements.

2.7 CONTROL

A. This system shall have a wired wall mounted thermostat/controller to perform input functions necessary to operate the system. The controller shall consist of a Power On / Off switch, Mode Selector, Temperature Setting, Timer Control, Fan Speed Select and Auto Vane Selector.

B. Temperature changes shall be by 1°F increments with a range of 65°F to 87°F.

C. There shall be a 24 hour On / Off timer.

D. The microprocessor located in the indoor unit shall have the capability of sensing return air temperature and indoor coil temperature, receiving and processing commands from the space controller, providing emergency operation and controlling the outdoor unit.

E. The control voltage between the indoor unit and the outdoor unit shall be 115 volts, AC.

F. The system shall be capable of automatic restart when power is restored after power interruption.

G. The control system shall control the operation of the air sweep louvers, as well as provide on / off and system / mode function switching.

2.8 OUTDOOR UNIT GENERAL

A. The outdoor unit is designed specifically for use with the indoor units. The outdoor unit shall be completely factory assembled, internally piped and wired. Each unit shall be

run tested at the factory.

B. When refrigerant lines are exposed on exterior of building provide “LINE-HIDE” line set cover system.
   1. Material, Weather resistant, UV stabilized, ASA/PVC/ABS/Poly/PE
   2. Assembly Screws, stainless steel.

2.9 UNIT CABINET

A. The casing shall be fabricated from zinc coated steel, bonderized with an electrostatically applied, thermally bonded, acrylic or polyester powder coating for corrosion protection.

B. Case and mounting feet shall be as follows:
   1. The base shall be of Aluminum-Zinc-Magnesium alloy coated steel, with welded mounting feet.

C. Cabinet mounting and construction shall be sufficient to withstand 155 MPH wind speed conditions for use in Hurricane condition areas. Mounting, base support, and other installation to meet Hurricane Code Conditions shall be by others.

2.10 FAN

A. The unit shall be furnished with a directive drive propeller type fan, statically and dynamically balanced for smooth and quiet operation.

B. The fan motor shall have inherent protection, be equipped with permanently lubricated bearings. The fan motor shall be mounted and isolated for quiet operation.

C. The fan shall be provided with a raised guard to prevent contact with moving parts.

D. The outdoor unit shall have horizontal discharge airflow.

2.11 COMPRESSOR

A. The compressor shall be a high performance, inverter driven rotary type.

B. Compressor shall be mounted using rubber isolating bushings to avoid the transmission of vibration.

C. Compressor shall be protected by an automatic over current relay and a thermal overload switch.

2.12 OPERATION

A. The outdoor unit shall have an accumulator.

B. The outdoor unit must have the ability to operate with a maximum height difference of 35 feet between indoor and outdoor units.

C. The unit shall have a maximum refrigerant tubing length of 65 feet between indoor and outdoor units without the need for line size changes, traps or additional oil. All refrigerant lines must be insulated.

D. The unit shall be pre-charged for a maximum of 25 feet of refrigerant tubing.

2.13 ELECTRICAL

A. Power supply shall be as indicated on the drawings.

B. The outdoor unit shall be controlled by the microprocessor located in the indoor unit. The control voltage between the indoor unit and the outdoor unit shall be 115 volts, AC.

2.14 WALL OR ROOF BRACKET

A. As indicated on the drawings, provide each unit 3 tons and below with a stainless steel mini-split condenser bracket.

B. Unit shall be constructed for a maximum weight of 300 lbs.

C. Unit shall be manufactured by Rectorseal model #WBB-300SS or Diveritech model #QSWB4000SS or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount condensing units on 4" foundation pads and pipe as shown on Drawings or as recommended by the equipment manufacturer. Install refrigerant filter dryer and sight indicating glass.

B. Install units on vibration isolation pads.

C. Ensure unit provided will meet the refrigerant and line lengths required by the installation as indicated on the drawings.

D. Provide convenience water and electrical within 50 feet of new condensing unit.

3.2 CONTROL WIRING

A. Furnish and install control wiring as required. Install control wiring in conduit.

3.3 DELIVERY, STORAGE AND HANDLING

A. Unit shall be stored and handled according to the manufacturer’s recommendations.

B. The wired controller shall be shipped inside the carton with the indoor unit and able to withstand 105°F storage temperatures and 95% relative humidity without adverse effect.

3.4 START-UP

A. Follow the manufacturer's start-up procedures.

B. Provide flexible elastomeric rubber closed cell insulation to prevent condensation from occurring op suction piping. After completion of successful start-up, installing contractor shall seal all openings in insulation and apply a protective aluminum sheetmetal jacket over insulation exposed on exterior of building.

END OF SECTION

SECTION 23 82 19

FAN COIL UNITS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Floor mounted decorative cabinet fan/coil units, horizontal fan/coil units for concealed installation and horizontal exposed ceiling mounted fan/coil units with decorative cabinet.

1.2 RELATED WORK

A. Division 23 Mechanical
   1. Air Balance
   2. Controls
   3. Electrical Provisions of Mechanical Work
   4. Ductwork
   5. Air filtration

1.3 REFERENCES

A. ANSI/AHRI 410 - force circulation air cooling and air heating coils

B. National Electrical Code

1.4 SUBMITTALS

A. Submit manufacturer's dimensioned product data sheets.
   1. Show location of filter access doors.

B. Submit fan performance curve for each unit:
   1. Plot fan volume against static pressure, horsepower and efficiency.
   2. Show point of rating based on static requirements of the system.

C. Submit the fan performance plot at each motor speed position with consideration for the reduced internal static.

D. Submit a chart of specific sound power level at each octave band center frequency. Sound power levels to occupied space shall not exceed the NC levels specified in 23 05 47 as calculated using ARI 885-98 Appendix E attenuation factors for mineral tile ceiling.

E. Submit manufacturer's certified heating and cooling coil capacity data.

F. Submit filter manufacturer's product data sheets and capacity information.

G. Submit manufacturer's data on housing insulation material.

1.5 CAPACITY

A. Refer to equipment schedule.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Carrier

B. Daikin

C. Trane

D. JCI

2.2 COMPONENTS

A. Fan section

B. V-belt drive assembly, or,

C. Multi-speed direct connected motor

D. Filter section, refer to section 23 41 00 for acceptable filter sizes.

E. Coil section

F. Insulated sheet metal cabinet with removable panels for access to the interior

G. Motor and drive inside the cabinet

2.3 FAN SECTION

A. Locate the motor and drive assembly inside the cabinet.

B. Belt drive units shall have each v-belt drive for 50% overload.
   1. Adjustable pitch motor pulley
   2. Provide built-in motor protection
   3. Belt adjustment means
   4. Type “B” belts only.

C. Direct drive units shall multi-speed direct connected fan motor with built-in motor protection.
   1. Three-speed windings
   2. Factory wired to a junction box with provisions for motor speed change, mounted on the box
   3. Resiliently mounted

D. Select the fan motor so that the brake horsepower required to deliver the design air quantity at the system static pressure will not exceed the motor nameplate amperage rating.

E. Supply Fans:
   1. Double width, double inlet, forward curve blade
   2. Statically and dynamically balanced
   3. Tested after being installed in the fan section
   4. Selected for the design air quantities and static pressure of the system
   5. Mounted on a common shaft if multiple wheels

F. Select fan to operate at or near its maximum efficiency point when handling the required air quantity and static pressure.

G. Fan Bearings:
   1. Permanently lubricated
   2. Self-aligning

2.4 DECORATIVE HOUSING AND PLENUM

A. Where units are exposed to view in occupied spaces and where scheduled, construct cabinets of cold rolled steel, bonderized and coated with baked enamel finish.

B. Access panels shall have position locking fasteners for easy removal.
   1. Plated screws with captive nuts
   2. Hinged if too large for one man operation

2.5 UNIT HOUSING

A. Construct the unit of galvanized steel sheets, and formed members.
   1. Provide structure to brace the assembly for the pressure of the system.

B. Bolt housing components together with neoprene gasketed airtight joints.

C. Internally insulate the entire unit with neoprene coated, 1-1/2 lb. density glass fiber insulation, applied to internal surfaces with adhesive and weld pins. Coat exposed edges of insulation with adhesive.

D. Insulation, vapor barriers, facings and adhesives:
   1. Flame spread not higher than 25
   2. Smoke developed rating not higher than 50

E. Condensation on the exterior of the unit is not approved.

F. Provide a duct flange on four sides of the return air inlet and supply air outlet of the unit.
   1. Sized to permit connection of the flexible connection to the ductwork
   2. Extend beyond the primary drain pan
   3. Minimum dimension 2"

G. Provide insulated, removable panels for access to the interior.
   1. Plated captive screws and nuts
   2. Neoprene gaskets

2.6 CONDENSATE DRAIN PANS

A. IAQ style drain pans shall be provided under all coils.
   1. Pitch to drain connection
   2. Fabricated from 16 gauge 304 stainless steel
   3. Triple pitched for complete drainage with no standing water
   4. Insulated to prevent condensation
   5. Welded corners
   6. Stainless drain connection

2.7 COILS

A. Reference Schedule and Specification Section 23 82 16.

2.8 FILTER SECTION

A. Locate behind access doors.
   1. Construct with substantial hinges
   2. Neoprene gaskets
   3. Permanent quick-release latching devices

B. Arranged to accommodate the 1" thick filters as specified.
   1. Single section filter - 16x20x2, 16x25x2, 20x20x2, 20x25x2 only.

C. Provide full length tracks to support the filter.

PART 3 - EXECUTION

3.1 SPARE PARTS

A. Provide the following spare parts and material to the Owner for use after the warranty period.
   1. One spare fan motor for each size of fan motor on the project
   2. One spare set of filters or filter media for each fan coil unit on the project

3.2 ELECTRICAL REQUIREMENTS

A. Bring electrical connections to a common junction box.

3.3 STORAGE

A. Storage and shipping in accordance with manufacturer's recommendations.

3.4 INSTALLATION

A. Install unit so motor connections and filters are accessible.

END OF SECTION

SECTION 26 01 05

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 05 00

ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Except as modified in this Section, General Conditions, and Supplementary Conditions, applicable provisions of Division 1 General Requirements, and other provisions and requirements of the Contract Documents apply to work of Division 26 Electrical.

B. Applicable provisions of this section apply to all sections of Division 26, Electrical.

1.2 CODE REQUIREMENTS AND FEES

A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.

B. Electrical work shall comply with applicable inspection services:
1. Underwriters Laboratories
2. National Fire Protection Association
3. State Health Department
4. Local Municipal Building Inspection Department adopted codes with amendments
5. National Electrical Code with local amendments
6. State Regulatory Agencies
7. Where the project is located outside a municipal jurisdiction, and has no municipal inspection services, the National Electrical Code with amendments of the municipality with extraterritorial jurisdiction shall govern.
8. Where the project is located outside any municipal jurisdiction, including extraterritorial jurisdictions, the National Electrical Code with local adopted amendments of the largest municipality located in the same county or parish shall govern.
9. International Energy Conservation Code
10. National Electrical Safety Code

C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.

D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.

E. Obtain all permits required.

1.3 CONTRACTOR'S QUALIFICATIONS

A. An approved contractor for the work under this division shall be:
   1. A specialist in this field and have the personnel, experience, training, and skill, and the organization to provide a practical working system.
   2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that has served their Owners satisfactorily for not less than 3 years.

1.4 REFERENCE SPECIFICATIONS AND STANDARDS

A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, APWA, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date proposals are received. Referenced specifications and standards are minimum requirements for all equipment, material and work. In instances where specified capacities, size or other features of equipment, devices or materials exceed these minimums, meet specified capacities.

B. Use electrical materials and equipment that is constructed and tested in accordance with the standards of NEMA, ANSI, ASTM, or other recognized commercial standard. If materials and equipment is labeled, listed, or recognized by any Nationally-Recognized Testing Laboratory (NRTL) acceptable to the Occupational Safety and Health Administration (OSHA), then provide NRTL-labeled, listed, or recognized material and equipment. Acceptable NRTLs include but are not limited to:
   1. Underwriters Laboratories, Inc. (UL)
   2. Factory Mutual Research Corp. (FMRC) (also referred to as “Factory Mutual Global,” or “FM Global”)
   3. Intertek Testing Services NA, Inc. (ITSNA, formerly ETL)
   4. Canadian Standards Association (CSA)
   5. A complete listing of acceptable NRTLs is published on the OSHA website at http://www.osha.gov/dts/otpca/nrtl/.

C. Where material and equipment is not labeled, listed, or recognized by any NRTL, provide a manufacturer’s Certificate of Compliance indicating complete compliance of each item with applicable standards of NEMA, ANSI, ASTM, or other recognized commercial standard.

D. Do not install or use electrical material or equipment for any use other than that for which it was designed, labeled, listed, or identified unless formally approved for such use by the Owner’s AHJ. This *National Electrical Code*® requirement is re-stated for emphasis.

E. Codes and Standards applicable to this Division:
   1. ANSI – American National Standards Institute
      a. ANSI Z535.1, Safety Colors
      b. ANSI Z535.2, Environmental and Facility Safety Signs
      c. ANSI Z535.3, Criteria for Safety Symbols
      d. ANSI Z535.4, Product Safety Signs and Labels
   2. ASHRAE – American Society of Heating, Refrigeration, and Air Conditioning Engineers:
      a. ASHRAE Standard 90.1, *Energy Standards for Buildings Except for*

Low Rise Residential Buildings [ANSI, IESNA]

3. ASTM – American Society for Testing and Materials
4. CBM – Certified Ballast Manufacturers
5. ICC – International Code Council
   a. International Building Code® (IBC)
   b. International Existing Building Code® (IEBC)
6. ICEA – Insulated Cable Engineers Association
   a. ICEA S-93-639, *Shielded Power Cables 5-46kV* (NEMA WC-74)
7. IEEE® - Institute of Electronics and Electrical Engineers
   a. IEEE C2™, *National Electrical Safety Code* (NESC) [ANSI]
   b. IEEE Std 141™, *Recommended Practice for Electric Power Distribution for Industrial Plans* ("Red Book")
   c. IEEE Std 143™, *Recommended Practice for Grounding of Industrial and Commercial Power Systems* ("Green Book")
   d. IEEE Std 241™, *Recommended Practice for Electric Power Systems in Commercial Buildings* ("Gray Book")
   e. IEEE Std 242 ™, *Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems* ("Buff Book")
   f. IEEE Std 315 ™, *Graphic Symbols for Electrical and Electronics Diagrams*
   g. IEEE Std 399 ™, *Recommended Practice for Power Systems Analysis* ("Brown Book")
   h. IEEE Std 446 ™, *Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications* ("Orange Book")
   i. IEE Std 493 ™, *Recommended Practice for the Design of Reliable Industrial and Commercial Power Systems* ("Gold Book")
   j. IEEE Std 519 ™, *Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems*
   k. IEEE Std 739 ™, *Recommended Practice for Energy Management in Industrial and Commercial Facilities* ("Bronze Book")
   l. IEEE Std 902 ™, *Guide for Maintenance, Operation , and Safety of Industrial and Commercial Power Systems* ("Yellow Book")
   m. IEEE Std 1015 ™, *Recommended Practice Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems* ("Blue Book")
   n. IEEE Std 11oo ™, *Recommended Practice for Powering and Grounding Electronic Equipment* ("Emerald Book")
   o. IEEE Std 1584 ™, *Guide for Performing Arc-Flash Hazard Calculations*
8. IESNA – Illuminating Engineering Society of North America
   a. IESNA *Lighting Handbook*, Ninth Edition
   b. IESNA RP-1, *American National Standard Practice for Office Lighting*
   c. IESNA RP-7, *American National Standard Practice for Lighting Industrial Facilities*
9. NECA – National Electrical Contractors Association:
   a. NECA 1, *Good Workmanship in Electrical Construction* [ANSI]
   b. NECA 90, *Recommended Practice for Commissioning Building Electrical Systems* [ANSI]
   c. NECA 100, *Symbols for Electrical Construction Drawings* [ANSI]
   d. NECA 101, *Standard for Installing Steel Conduits (Rigid, IMC, EMT)* [ANSI]
   e. NECA 104, *Recommended Practice for Installing Aluminum Building Wire and Cable* [ANSI]

f. NECA / NEMA 105, *Recommended Practice for Installing Metal Cable Tray Systems* [ANSI]
g. NECA 111, *Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC)* [ANSI]
h. NECA / NACNA 120, *Standard for Installing Armored Cable (Type AC) and Metal-Clad Cable (Type MC)*[ANSI]
i. NECA 202, *Recommended Practice for Installing and Maintaining Industrial Heat Tracing Systems* [ANSI]
j. NECA 230, *Standard for Selecting, Installing and Maintaining Electric Motors and Motor Controllers* [ANSI]
k. NECA 331, *Standard for Building and Service Entrance Grounding and Bonding*
l. NECA 400, *Standard for Installing and Maintaining Switchboards* [ANSI]
m. NECA 402, *Standard for Installing and Maintaining Motor Control Centers* [ANSI]
n. NECA / EGSA 404, *Standard for Installing Generator Sets* [ANSI]
o. NECA 407, *Recommended Practice for Installing and Maintaining Panelboards* [ANSI]
p. NECA 408, *Recommended Practice for Installing and Maintaining Busways* [ANSI]
q. NECA 409, *Recommended Practice for Installing and Maintaining Dry-Type Transformers* [ANSI]
r. NECA 410, *Recommended Practice for Installing and Maintaining Liquid-Filled Transformers* [ANSI]
s. NECA 411, *Recommended Practice for Installing and Maintaining Uninterruptible Power Supplied (UPS)* (ANSI]
t. NECA 420, *Standard for Fuse Applications* [ANSI]
u. NECA 430, *Standard for Installing Medium-Voltage Metal-Clad Switchgear* [ANSI]
v. NECA / IESNA 500, *Recommended Practice for Installing Indoor Lighting Systems* [ANSI]
w. NECA / IESNA 501, *Recommended Practice for Installing Exterior Lighting Systems* [ANSI]
x. NECA / IESNA 502, *Recommended Practice for Installing Industrial Lighting Systems* [ANSI]
y. NECA / MACSCB 600, *Recommended Practice for Installing and Maintaining Medium-Voltage Cable* [ANSI]
z. NECA / NEMA 605, *Installing Underground Nonmetallic Utility Duct* [ANSI]

10. NEMA – National Electrical Manufacturers Association
11. NETA – International Electrical Testing Association, Inc.:
    a. NETA ATS, *Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems*
    b. NETA MTS, *Maintenance Testing Specifications for Electrical Power Distribution Equipment and Systems*
    c. NETA ETT, *Standard for Certification of Electrical Testing Technicians* [ANSI]
12. NFPA – National Fire Protection Association:
    a. NFPA 20®, *Standard for the Installation of Stationary Pumps for Fire Protection®*
    b. NFPA 70™, *National Electrical Code® (NEC®)*
    c. NFPA 70E, *Standard for Electrical Safety in the Workplace.*
    d. NFPA 101®, Life Safety Code®
    e. NFPA 110, *Standard for Emergency and Standby Power Systems*

f. NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*
g. NFPA 780, *Standard for the Installation of Lightning Protection Systems*
h. All other NFPA codes and standards except NFPA 5000

13. OSHA – Occupational Safety and Health Administration
14. IECC – International Energy Conservation Code
15. ISO – International Organization for Standardization
16. State and Local Energy Conservation Code
17. Applicable County and Municipal Codes

1.5 CONTRACT DRAWINGS

A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

B. Every effort has been made by the Engineer to indicate wiring of all receptacles, light fixtures, switches, telephone outlets, HVAC equipment, other equipment, elevator equipment, and all other devices / appliances requiring electrical power. It is the intent of the Engineer that all light fixtures be powered and controlled unless specifically noted on the plans; that all wiring devices (receptacles and direct connected equipment) be circuited to a power source of the correct voltage and that all HVAC, elevator equipment and other equipment be properly wired to the correct voltage power source; that all communications and security systems devices and equipment and all fire alarm system devices and equipment are installed, wired and systems are fully operational.

C. It is the responsibility of the Contractor to review the construction drawings (reflected ceiling plans) for light fixtures, casework elevation details for electrical devices which are not indicated on the electrical drawings; to review the mechanical and plumbing documents and all other drawings to determine the electrical rough-ins for all equipment requiring power connections, and to include in their proposals the correct and complete electrical rough-ins for all of these items which were inadvertently not indicated on the electrical drawings, OR the Contractor shall specifically enumerate each item requiring electrical rough-in which is not specifically shown on the electrical drawings, and indicate the electrical provisions of these items as specifically excluded from his proposal.

D. It is the responsibility of the Contractor to compare the scale of all electrical drawings with the scale of the architectural drawings and make adjustments to all electrical drawings which have the incorrect drawing scale so that his material takeoffs are not in error due to an incorrectly labeled drawing scale and his proposal is complete.

E. No proposal shall be accepted which specifically excludes any of the provisions of paragraphs B, C, or D above.

1.6 PROJECT RECORD DOCUMENTS

A. Maintain at the job site a separate set of white prints (black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is significantly at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various major and minor feeders, equipment, and other pertinent items, as installed. Record underground and under slab service and feeders installed,

dimensioning exact location and elevation of such installations.

B. At conclusion of project, obtain without cost to the Owner, electronic PDF and AutoCAD 2014 and / or Revit CAD files of the original drawings and transfer as-built changes to these. Provide the following as-built documents including all contract drawings regardless of whether corrections were necessary and include in the transmittal: “2 sets of CDs and prints for Owner’s use, one set of CDs, prints, and mylars for Architect / Engineers Records”. Delivery of these as-built electronic, reproducibles and prints is a condition of final acceptance.
   1. 3 sets of electronic AutoCAD (2014 dwg) and / or Revit CAD drawing files, on CD-ROM media, of each contract as-built drawing.
   2. One reproducible Dayrex Mylar film positive of each contract as-built drawing.
   3. Three sets of blue-line prints of each contract as-built drawing.
   4. Three sets of pdf prints of each contract as-built drawing on CD.

C. As-Built Drawings should indicate the following information as a minimum:
   1. Indicate all addendum changes to documents.
   2. Remove Engineer’s Seal, name, address, and logo from drawings.
   3. Mark documents RECORD DRAWINGS.
   4. Clearly indicate: DOCUMENT PRODUCED BY:
   5. Indicate all changes to construction during construction. Indicate actual routing of all conduits, etc. that was deviated from construction drawings.
   6. Indicate exact location of all underground electrical raceways, and elevations.
   7. Correct schedules to reflect (actual) equipment furnished and manufacturer.
   8. During the execution of work, maintain a complete set of Drawings and specifications upon which all locations of equipment, devices, and all deviations and changes from the construction documents in the work shall be recorded.
   9. Exact location of all electrical equipment in building. Label panel schedules to indicate actual location.
   10. Exact location of all electrical equipment in and outside of the building.
   11. Exact location of all outdoor lighting poles and equipment.
   12. Location, size and routing of all feeder conduits, equipment, etc. shall be accurately and neatly shown to dimension.
   13. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
   14. Cloud all changes.
   15. Update all panel schedules with all additional circuits added or deleted through construction. Identify each circuit to include all information specified for directory cards for circuit identification in panelboards.

1.7 SPACE REQUIREMENTS

A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.8 RELATION WITH OTHER TRADES

A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements. Extend electrical services and final connections to all items requiring same.

B. Because of the complicated relationship of this work to the total project,

conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.

C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them.

D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.

E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under other Division. Determine from the General Contractor / Construction Manager for the various trades, the Owner, and by direction from the Architect / Engineer, the exact location of all items. The construction trades involved shall furnish all roughing-in drawings and wiring diagrams required for proper installation of the electrical work.
   1. Make final electrical connections to all electrically operated equipment indicated on the drawings, except as noted.
   2. The responsibility for alignment of motor and driven equipment is specified in the related division.

F. Request all Shop Drawings required in ample time to permit proper installation of all electrical provisions.

G. Extend services as indicated to the various items of equipment furnished by others. Rough-in for the various items and make final connections ready for operation upon placing of the equipment.

1.9 CONCEALED AND EXPOSED WORK

A. When the word "concealed" is defined as hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is defined as open to view, in plain sight.

1.10 GUARANTEE

A. Guarantee work for 1 year from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. Replacement of failed parts or equipment shall be provided.

1.11 MATERIAL AND EQUIPMENT

A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.12 NOISE AND VIBRATION

A. Select equipment to operate with minimum noise and vibration. If noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, and judged objectionable by the Owner, Architect, or Engineer, rectify such conditions at no additional cost to the Owner. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.13 ACCEPTABLE MANUFACTURERS

A. Manufacturers names and catalog number specified under sections of Division 26 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, materials, energy efficiency characteristics (where applicable) and lighting performance characteristics (where applicable) equal to that specified, manufactured by a named manufacturer shall be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before proposal due date. Submit a marked-up set of the relevant specification section indicating all variances, a comparison to the specified product, and of construction and performance criteria, complete design and performance data for the specified product and the proposed substitution for comparison to the Engineer. The Architect issues approvals of acceptable manufacturers as addenda to the Construction Proposal Documents.

1.14 UTILITIES, LOCATIONS AND ELEVATIONS

A. Locations and elevations of the various utilities included within the scope of this work:
   1. Obtained from utility maps and other substantially reliable sources.
   2. Are offered separate from the Contract Documents as a general guide only without guarantees to accuracy.

B. Examine the site and verify the location and elevation of all utilities and of their relation to the work. Existing utilities indicated on the site plans are for reference only and shall be field verified by the Contractor with the respective public or private utility.

1.15 OPERATING TESTS

A. After all electrical systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect / Engineer and Owner. Provide minimum 24-hour advance notice of scheduling of all tests. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.16 WARRANTIES

A. All normal and extended warranties shall include parts, labor, miscellaneous materials, travel time, incidental expenses, normal freight / shipping, refrigerant, oils, lubricants, belts, filters and any expenses related to service calls required to diagnose and correct warranty problems.

B. Manufacturer’s warranty shall be from one year from date of substantial completion. Contractor shall be responsible for extending the warranties regardless of date of installation or commissioning.

C. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.17 BUILDING CONSTRUCTION

A. It shall be the responsibility of the sub-contractor to consult the Contract Drawings,

details and specifications and thoroughly familiarize himself as to the construction and all job related requirements. All construction trades shall cooperate with the General Contractor / Construction Manager Job site superintendent and lay out work so that all raceways and other items are placed in the walls, furred spaces, chases, etc., so that there shall be no delay in the job.

1.18 TEMPORARY FACILITIES

A. General: Refer to Division 1 for general requirements on temporary facilities.

B. Temporary Wiring: Temporary power and lighting for construction purposes shall be provided under this Division. Installation of temporary power shall be in accordance with NEC Article 527.

C. Temporary facilities, wire, lights and devices are the property of this Contractor and shall be removed by this Contractor at the completion of the Contract.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 IDENTIFICATION OF EQUIPMENT

A. Identification of Equipment:

1. All major equipment shall have a manufacturer's label identifying the manufacturer's address, equipment model and serial numbers, equipment size, and other pertinent data. Take care not to obliterate this nameplate. The legend on all nameplates or tags shall correspond to the identification shown on the Operating Instructions. All panels, cabinets, or equipment requiring 120 volt or higher power shall be labeled as required which includes circuit designation and circuit panelboard location, regardless of which discipline installs the equipment.
2. Three layer laminated plastic engraved identifying nameplate shall be permanently secured to each switchboard, distribution panel, motor control center, transformer, panelboard, safety disconnect switch, enclosed circuit breaker, transfer switches, remote generator transfer deices not installed inside light fixtures, wireway, busduct plug, terminal cabinet, surge protective device, capacitor, individual motor controller, contactor, fire alarm panels (main and remote booster), and communications (voice, data, video) cabinet or rack, security panels, time clocks, BMCS cabinets, sound reinforcement cabinets and racks, miscellaneous control cabinets, equipment integral disconnect switches, toggle or motor switches, disconnects for equipment, exterior junction boxes, exterior pull boxes, exterior wireways and gutters, and rooftop equipment (i.e.: supply and exhaust fans, rooftop HVAC equipment) with stainless steel screws.
   a. Utility Power: White letters on black background
      Generator Power (White letters on red background
      UPS Power: White letters on blue background
      Load Bank Circuits: White letters on green background
      Solar or Wind Power Generation: White on orange background
   b. Identifying nameplates shall have 1/2-inch high, engraved letters for equipment designation and ¼-inch letters indicating source circuit designation, (i.e.: “PANEL HA –fed from MDP-6 located in Mech. Rm. 100”). The words “fed from” and “located” shall be included in the labeling.

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 ¼-inch high, engraved letters. Circuit breaker name and kirk key designation if applicable

d. Each section of multiple section panelboards shall also indicate panelboard section number (i.e.: Panel "HA-Section 2 – fed from MDP-6 located in Mech. Rm. 100")

e. Motor Controllers, starters, and contactors: Provide neatly typed label inside each motor controller and contactor enclosure door identifying motor or load served, nameplate horsepower, full load amperes, code letter, service factor, and voltage / phase rating.

f. Individual motor controller and contactor nameplates shall include load served, location of load served, panel and circuit numbers serving load, location of panel serving load, panel and circuit number serving control circuit, location of panel serving control circuit (if different from panel serving load), description and location (if applicable) of control controlling contactor (i.e. Controlled: Switch in RM 100, and Controlled: BMCS). Contactor nameplate is to include whether it is a lighting or receptacle contactor and name of contactor. i.e. C-1.

Lighting Contactor Example	Receptacle Contactor Example
Lighting Contactor C1 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	Wall Mounted Lighting ATS Example
ATS-1	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 20 hours dedicated instructor time
   2. 4 hours on each of 5 days
   3. Additional instruction time for specific systems as specified in other Sections.

C. Before on-site training, submit the program syllabus; proposed time and dates; for review and approval, minimum 48 hours prior to proposed training time and date.
   1. One copy to the Owner
   2. One copy to the Architect / Engineer

D. The Owner shall provide a list of personnel to receive instructions, and shall coordinate their attendance at the agreed upon times.

E. Use operation and maintenance manuals as the basis of instruction. Review manual with personnel in detail. Explain all aspects of operation and maintenance.

F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shut down of each item of equipment.

G. Demonstrate equipment functions (both individually and as part of the total integrated system).

H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.

I. Submit a report within one week after completion of training. List time and date of each demonstration, hours devoted to the demonstration, and a list of people present, with their respective signatures.

J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he / she has a proper understanding of the

system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.

K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

3.4 OPENINGS

A. Framed, cast or masonry openings for boxes, equipment or conduits are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.5 HOUSEKEEPING PADS

A. Provide concrete equipment housekeeping pads under all floor and outdoor mounted electrical equipment.

B. Concrete and reinforcing steel shall be as specified in Division 3, or as indicated or noted.

C. Concrete pads:
1. 6-inches thick minimum indoors; 8-inches thick minimum outdoors, or match existing if indicated on the drawings to extend existing pads, or in other sections of the specifications.
2. Chamfer strips at edges and corner of forms.
3. Smooth steel trowel finish.
4. Extend 3-inches minimum indoors beyond perimeter of equipment unless otherwise shown.
5. 6-inch x 6-inch #8 wire reinforcement mesh.

3.6 OBSTRUCTIONS

A. The drawings indicate certain information pertaining to surface and subsurface obstructions, which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.

B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.7 VANDAL RESISTANT DEVICES

A. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner 2 suitable tools for use with each type of fastener used, and 25 percent spare fasteners.

B. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.8 PROTECTION

A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

B. Do not deliver equipment to this project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather shall be rejected, and the contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.

3.9 COORDINATION OF BRANCH CIRCUIT OVERCURRENT AND PROTECTION DEVICES

A. Review with equipment specified which requires electrical connections. Review equipment shop drawings and manufacturer's nameplate data and coordinate exact branch circuit overcurrent protective device and conductors with equipment provided.
   1. Provide equipment manufacturer's recommended overcurrent protective device indicated on nameplate at no additional cost to the Owner.
   2. If branch circuit conductors and / or conduit sizing is less than the minimum required by equipment manufacturer, notify the Architect / Engineer immediately, prior to rough-in.
   3. If equipment manufacturer is a substitution to the specified equipment manufacturer, provide the greater of the conductors specified or those required for the installed equipment manufacturer’s minimum circuit conductors, at no additional cost to the Owner.
   4. If conductors indicated on plans are in excess of that permitted by equipment manufacturer, notify Architect / Engineer immediately, prior to rough-in.
   5. If conductors indicated on plans are in excess of that permitted by the equipment manufacturer, provide the maximum conductors permitted by the equipment manufacturer based on NEC ampacity tables, either in a single set, or as a set of parallel conductors as permitted by the NEC. Conductor size and quantity entering the equipment enclosures shall not exceed the equipment manufacturer’s maximum recommendations.

3.10 FAULT CURRENT AND ARC FLASH STUDY FOR OVERCURRENT DEVICE COORDINATION

A. Contractor shall provide a coordination study, fault current analysis, and Arc-Flash study report for new electrical distribution equipment downstream to the last new overcurrent device in each feeder or branch circuit, conducted and prepared by the switchgear manufacturer. The coordination study and fault current analysis shall include the manufacturer’s recommendations for all adjustable overcurrent devices specified or provided. Study does not require inclusion of existing switchgear, except it shall include existing or new overcurrent devices in existing switchgear serving new switchgear. Contractor shall submit the report results prior to submitting switchgear submittals to allow changes or modifications to equipment selection.

B. Contractor shall adjust all overcurrent device settings based on manufacturer’s recommendations, or as directed by Owner / Architect at no additional cost to Owner. Settings for GFI shall be set at maximum as permitted by the NEC.

C. Arc-Flash & Shock-Hazard Warning Labels: Provide arc-flash and shock hazard-

warning labels that comply with ANSI Z535.4 on switchgear, switchboards, transformers, motor control centers, panelboards, motor controllers, safety switches, industrial control panels and other equipment that is likely to require examination, adjustment, servicing, or maintenance while energized. Locate the marking to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment. On renovation projects, install arc-flash warning labels on existing equipment where lock-out / tag-out will be required for the renovation work. Provide the information listed below on each label. Specify that arc-flash warning label information be produced by the electrical equipment manufacturer or supplier as a part of the final power system studies to be submitted by the Contractor in accordance with the electrical acceptance testing.

1. Note: In addition to the final arc-flash analysis, the final power system studies include load flow and fault-current calculations, and an overcurrent protective device (OCPD) coordination study based on the actual equipment to be installed for the project.

D. Information to be determined and applied to electrical equipment:
   1. Arc-Flash Protection Boundary
   2. Arc-Flash incident energy calculated in accordance with IEEE Std 15841 ™
   3. Working distance calculated in accordance with IEEE Std 1584a ™
   4. NFPA 70E Hazard / Risk Category Number or the appropriate personal protective equipment (PPE) for operations with doors closed and covers on.
      a. Typical operations include operating circuit breakers, fused switches, and meter selector switches.
   5. System phase-to-phase voltage
   6. Condition(s) when a shock hazard exists (e.g. “With cover off”)
   7. Limited Approach Boundary as determined from NFPA 70E, Table 130.2(C)
   8. Restricted Approach Boundary as determined from NFPA 70E, Table 130.2(C)
   9. Prohibited Approach Boundary as determined from NFPA 70E, Table 130.2(C)
   10. Unique equipment designation or code (described under “Component Identification”
   11. Class for insulating gloves based on system voltage (e.g., Class 00 up to 500V)
   12. Voltage rating for insulated or insulating tools based on system voltage (e.g., 1000V)
   13. Date that the hazard analysis was performed.
   14. “Served from” circuit directory information including the serving equipment designation, location (e.g., room number), circuit number, and circuit voltage / number of phases / number of wires.
   15. If applicable, the “serves” circuit directory information including the served equipment designation, location (e.g., room number), circuit number, and circuit voltage / number of phases / number of wires.
   16. An abbreviated warning label may be used where it has been determined that no dangerous arc-flash hazard exists in accordance with IEEE 1584a ™, paragraph 9.2.3.
   17. Use a “DANGER” label where the calculated arc-flash incident energy exceeds 40 cal/cm.

E. Submittals: Submit four copies of coordination study and certified fault current study results to the Architect for review.

3.11 EQUIPMENT BACKBOARDS

A. Backboards: ¾ inch, fire retardant, exterior grade plywood, painted gray, both sides.
   1. Provide minimum of two 4-ft. by 8-ft. sheets of plywood for each new telephone equipment terminal location.
   2. Provide minimum of two 4-ft. by 4-ft. sheets of plywood for each new data / voice / video / communications equipment location / cable TV head end equipment, or security equipment location.

3.12 TESTING

A. The contractors for the various sub-systems shall submit proposed testing procedures for their systems, subject to review and approval and Owner acceptance. The contract will not be declared to be substantially complete until the functional operation of the subsystems have been demonstrated and verified and reports have been provided, reviewed and accepted.

B. The project will not be declared substantially complete until the following has taken place.
   1. The “As-Built” drawings have been submitted, reviewed and accepted by the Architect / Owner / Owner’s Construction Representative.
   2. The building emergency lighting system and other systems including but not limited to those listed below have been tested, completed factory start-up and programming and adjusting as required for a complete and fully operational system acceptable to the Architect and Owner.
      a. Occupancy Sensor and Lighting Controls
      b. Surge protective device equipment
      c. Overcurrent devices
      d. Motor Controllers
      e. Emergency Lighting
      f. Building Fire Alarm System

3.13 LOAD BALANCING

A. Balance the loads on each low-voltage feeder so that the voltage on each phase is within +/- 1.0% of the average voltage of the three phases. Refer to the DOE Office of Industrial Technologies, “Motor Tip Sheet #7” dated September 2005 available for download to PDF format at no charge at:

   http://www1.eere.energy.gov/industry/bestpractices/pdfs/eliminate_voltage_un_balanced_motor-systemts7.pdf

END OF SECTION

SECTION 26 05 05

ELECTRICAL ALTERATIONS PROJECT PROCEDURES

PART 1 – GENERAL

1.1 WORK INCLUDED

A. Inspection and service of existing equipment and materials to remain or be reused.

B. Handling of equipment and materials to be abandoned.

C. Handling of equipment and materials to be removed.

1.2 QUALITY ASSURANCE

A. Coordination with the Contractor prior to the disconnection or shutdown of existing equipment, or to the modification of existing operational systems.

1.3 CONTRACT DRAWINGS

A. There is the possibility that there exist conditions and devices that are affected by the work indicated on the drawings and called for in the specifications (project manual) that do not appear on the drawings. It is the Contractors responsibility to visit the site and determine all of the existing conditions and to consider these existing conditions when making and presenting a proposal, to have a complete proposal.

PART 2 – PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Material used to upgrade and repair existing equipment shall conform to that specified.

B. Material used to upgrade and repair existing equipment shall not void existing warranties or listings of the equipment to be upgraded or repaired.

C. Material used to upgrade and repair existing equipment shall be new and shall be of the same manufacturer of the existing equipment, shall be acquired through the existing original equipment manufacturer’s approved distribution channels, shall have manufacturer’s warranties for the new material being used, and shall be listed for the use intended.

PART 3 – EXECUTION

3.1 INSPECTION

A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be inspected for damaged or missing parts. Notify the Architect / Engineer, in writing, accordingly.

B. If using materials specified or shown on the drawing voids or diminishes the warranty or operation of remaining equipment or systems, the Contractor shall notify the Architect / Engineer, in writing.

C. Verify field measurements and circuiting arrangements.

D. Verify that abandoned wiring, panelboards, and switchboards, disconnect switches, and equipment serve only abandoned facilities. Where abandoned wiring, panelboards, switchboards, and equipment which serve existing facilities are to remain, Contractor shall provide means and methods to ensure existing facilities remain energized with the correct voltage, overcurrent protection, conductors, and circuit ampacity required by the existing facilities to remain.

E. Demolition Drawings are based on casual field observation, and when available, existing record documents. Report discrepancies to Architect before disturbing existing installation, and immediately after such discrepancies are discovered.

3.2 APPLICATION

A. Existing materials and equipment indicated on the drawings or in the specification to be reused shall be cleaned and reconditioned, including tightening of feeder and bus bar lugs prior to installation and reuse in the modified system.

B. Remove existing luminaries for alterations/renovations. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. For each luminarie that is taken down for alteration and then reinstalled, replace damaged parts, provide new lamps and, with matching paint, touch-up scratched or abraded areas, and replace cracked, broken or missing lenses or diffusers. Replace unrepairable fixtures with new fixtures.

C. Material and equipment removed that is not to be salvaged for Owner's use or for reuse on the project shall become the property of the Contractor and shall be removed from the site.

D. Prior to start of construction, Contractor shall walk areas to be renovated with Owner to identify and document items to be salvaged for Owner’s use.

E. Material or equipment salvaged for Owner's use shall be carefully handled and stored where directed by the Owner.

F. Materials and equipment not indicated to be removed or abandoned shall be reconnected to the new system.

G. Clean and repair existing materials and equipment that remain or are to be reused.

H. Panelboards Reused and Modified for Renovation: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

3.3 SEQUENCING AND SCHEDULING

A. Coordinate utility service outages with Utility Company, Architect and Owner.

B. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits use personnel experienced in such operations.

C. Existing Electrical Service: Refer to drawings for work in remodeled areas. Where facilities in these areas are to remain in service, any related work to keep the facilities

in operation is specified in this Division. Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain written permission from Owner at least 10 business days before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Disclose the extent, exact time and expected duration of the outage in a written request to the Owner.

D. Remove and replace existing conduit, wiring, outlets, devices, lighting fixtures, panels and appurtenances as occasioned by new or remodeled construction. Re-establish service to lights, switches and devices that may be interrupted by remodeled construction.

E. Disconnect electrical systems in walls, floors and ceilings scheduled for removal. When outlets are removed, wire shall be pulled out of the conduit back to the nearest remaining box or cabinet.
   1. Remove exposed conduit that has been abandoned.
   2. Cap conduit beyond the finish line.
   3. Provide unswitched circuit leg for emergency battery powered equipment; circuit from same branch circuit breaker as switched normal lighting circuit.

F. Where new/existing luminaries or devices are shown being connected to existing circuits:
   1. Field verify existing system voltage
   2. Provide ballast / device to match system voltage

G. Verify the loading of each circuit affected by remodeling work. The maximum load of any branch circuit shall not exceed 80% of its rating.

H. Remove equipment, systems, conductors, wiring, raceways, etc. abandoned or not required for existing or new systems. Coordinate with Architect / Owner for salvage by Owner. Remove abandoned / not required raceways and wiring back to nearest box serving load to remain, or back to panel if not serving remaining load.

I. Existing Power, and Lighting and Appliance Branch Circuit Distribution System: Maintain existing system in service unless as noted or specified otherwise. Disable system only to make switchovers and connections. Notify Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.

J. Existing Lighting System: Maintain existing system in service unless as noted or specified otherwise. Disable system only to make switchovers and connections. Notify Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.

K. Existing Fire Alarm System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify Owner and local fire service at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.

L. Existing Telephone System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify Owner and Telephone Company at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.

M. Existing Paging and Sound Reinforcement Systems: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.

N. Existing Data Network: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.

O. Existing Video Distribution System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.

P. Existing Security System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.

Q. Existing Video Surveillance System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.

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 05 10

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 05 12

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 roduct ot 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. Substutions 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 requried 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. Sports Lighting Equipment, Fixtures, Poles

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 05 19

CONDUCTORS AND CONNECTORS – 600 VOLT

PART 1 – GENERAL

1.1 WORK INCLUDED

A. Provide electrical conductors, wire and connector work as shown, and specified.

B. Types: The types of conductors and connectors required for the project include the following:
   1. 600V building conductors
   2. 600V building conductor connectors

C. Application: The applications for conductors and connectors required on the project are as follows:
   1. Power distribution circuitry
   2. Lighting branch circuitry
   3. Appliance, receptacle, and equipment branch circuitry
   4. Motor branch circuitry
   5. Control wiring
   6. Line voltage

D. Refer to other specific specification sections for voice, video, data, alarm and instrumentation cables.

1.2 QUALITY ASSURANCE

A. UL Label: Conductors and connectors shall be UL labeled.

1.3 REFERENCES

A. Refer to other specific specification sections regarding specialized wiring and connections.

PART 2 – PRODUCTS – 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. 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.

C. 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.

D. 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.

2.2 COLOR CODES FOR CONDUCTORS FOR BRANCH CIRCUITS AND FEEDERS

A. Color coding for conductors as required by NEC 210.5. Color coding for phase and voltage shall be as required by local codes and local standards. Where such standards do not exist, color coding shall be as follows:

Color Code Table	USE CONTINUOUS COLOR CODED INSULATION THROUGHOUT					
System/ Phase	**A**	**B**	**C**	**N**	**G**	**IG**
120/208 3 Ph	Black	Red	Blue	White	Green	Green/Yellow Stripe
120/240 3 Ph	Black	Orange	Blue	White	Green	Green/Yellow Stripe
120/240 1 Ph	Black	N/A	Blue			
277/480	Brown	Purple	Yellow	Gray	Green	Green/Yellow Stripe

Notes to Color Code Table:
1. 120/208, 120/240, and 277/480 Volt Systems shall be routed in separate raceways.
2. Switched legs of phase conductors for lighting and appliance branch circuits shall be of the same color as described above throughout the entire circuit.
3. Conductors shall be the same color from breaker to device or outlet.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General: Install electrical conductors and connectors as shown, in accordance with the manufacturer's written instructions, the requirements of NEC, the NECA Standard of Installation, and industry practices.

B. Coordination: Coordinate conductor installation work with electrical raceway and equipment installation work, as necessary for interface.

C. Conductors:
   1. Provide a grounded (neutral) conductor for each branch circuit. Do not share grounded (neutral) conductors.
   2. No more than six phase conductors shall be installed in a single raceway. Any combination of phase conductors and grounded (neutral) conductors in any raceway shall not exceed nine.
   3. When any combination of four or more phase and grounded (neutral) conductors are installed in a raceway, the minimum size for all conductors including equipment ground conductor shall be #10 AWG, and they shall be de-rated accordingly.
   4. When more than four (4) conductors are size #10 AWG, they shall be installed in a one-inch conduit.

5. Pull conductors together when more than one is being installed in a raceway. Whenever possible, pull conductors into their respective conduits by hand. Use pulling lubricant when necessary.
6. Before any conductor is pulled into any conduit, thoroughly swab the conduit to remove foreign material and to permit the wire to be pulled into a clean, dry conduit.
7. Run feeders their entire length in continuous section without joints or splices.
8. No wire smaller than #12 AWG shall be permitted for any lighting or power circuit. No wire smaller than #14 AWG shall be used for any control circuit, unless shown otherwise.
9. Provide the same size wire form the panelboard to last outlet on circuit. For 20 amp branch circuits operating at 150V or less, provide #10 AWG wire when the first outlet is over 75-feet from the panelboard. For branch circuits operating at 150 to 600 volts, provide #10 AWG wire when the first outlet is over 150-feet from the panelboard.
10. Branch circuit voltage drop shall not exceed 3% of rated voltage.
    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. Identification: Label each phase conductor in each junction box with corresponding circuit number, using self-adhesive wire markers.

E. Splices and Joints:
   1. In accordance with UL 486A, C, D, E, and NEC.
   2. Aboveground Circuits (No. 10 AWG and smaller):
      a. Connectors: Solderless, screw-on, reusable pressure cable type, rated 600 V, 220˚ F, with integral insulation, approved for copper and aluminum conductors. 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.

F. Aboveground Circuits (No. 8 AWG and larger):
   1. Connectors shall be indent, hex screw, or bolt clamp type of high conductivity and corrosion resistant material, listed for use with copper and aluminum conductors.
   2. Provide field-installed compression connectors for cable sizes 250 kcmil and larger with not less than two clamping elements or compression indents per wire.
   3. Insulate splices and joints with materials approved for the particular use, location, voltage, and temperature. Splice and joint insulation level shall be not less than the insulation level of the conductors being joined.
   4. Plastic electrical insulating tape: Per ASTM D2304, flame-retardant, cold and weather resistant.

G. Underground Branch Circuits and Feeders:
   1. Submersible connectors in accordance with UL 486D, rated 600 V, 190˚F, with integral insulation.

3.2 TESTING

A. Pre-Energization Check: Before energizing, check cable and conductors for circuit continuity and short circuits. Correct malfunctions.

B. Service Entrance and Feeder Insulation Resistance Test: Each main service entrance conductor and each feeder conductor shall have its insulation resistance tested after the installation is complete except for connection at its source and point of termination. Testing shall be performed by qualified technicians who have been trained in testing procedures and in the use of all test equipment.

1. Make tests using a Biddle Megger or equivalent test instrument at a voltage of not less than 1000 VDC; measure resistance from conductor to conductor, conductor to neutral (if present) and from conductor to ground. Insulation resistance shall not be less than the following:

Wire Size (AWG)	Insulation Resistance (Ohms)
#8	250 K
#6 through #2	100 K
#1 through #4/0	50 K
Larger than #4/0	25 K

2. Conductors that do not meet or exceed the insulation resistance values listed above shall be removed, replaced, and retested.

C. Submittals: Contractor shall furnish instruments and personnel required for tests. Submit 4 copies of certified test results to Architect for review. Test reports shall include conductor tested, date and time of test, relative humidity, temperature, and weather conditions.

D. Voltage and Current Values: The voltage and current in each conductor shall be measured and recorded after connections have been made and the conductor is under load.

SAMPLE DC HIGH VOLTAGE CABLE TEST REPORT
(Specification Paragraph 3.2, C)

Date_____

Contract and Work Location: ___
Contract (Project) No.: _
Circuit Identification: ___
(Dwg., Title, Number and Ckt. Number)

Test Equipment: _____
(Make, Model, Serial No., Etc.)
Applied Test Voltage _____
Normal Oper. Voltage _____
Cable Installation: New _____ Used _____
(Date) (No. Years)
Cable Size _____AWG
Cable Length _____Ft.
Cable Material _____Cu _____Al
Temperature _____ Humidity _____

TEST DATA - RESISTANCE IN KILO OHMS

CONDUCTOR PER PHASE	A-N	B-N	C-N	A-G	B-G	C-G	A-B	B-C	A-C

END OF SECTION

SECTION 26 05 26

ELECTRICAL GROUNDING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Grounding shall conform to the requirements of:
   1. National Electrical Code.
   2. Governing local codes.
   3. All Local Utility Companies

B. Ground effectively and permanently.
   1. Neutral conductor at the main service disconnect and other separately derived systems.
   2. All conduit systems.
   3. All electrical equipment and related current carrying supports or structures.
   4. All metal piping systems.
   5. All building structural metal frames.
   6. All telephone/voice/video/CATV/data utilities

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.

2. UL listed.
3. Approved thermal fusion connector methods (exothermic).

B. Metal frame of building or enclosure.

C. Foundation concrete encased rebar.

2.3 DATA / VOICE COMMUNICATIONS CLOSET GROUND BAR

A. MDF closets/head end rooms: Erico Cadweld #B544A028 ground bar with 7/16-inch holes.

B. IDF closets, Erico Cadweld #B542A004 ground bar with 7/16-inch holes.

C. Heavy-duty, two bolt type, copper alloy or bronze for grounding and bonding applications, in configurations required for particular installation.

2.4 EXOTHERMIC CONNECTIONS

A. Exothermic type for underground and structural steel; Cadweld

B. Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

2.5 WIRE

A. Stranded, copper cable

B. Foundation Electrodes: 4/0 AWG

C. Grounding Electrode Conductor: Size to meet NFPA 70 requirements

PART 3 – EXECUTION

3.1 GROUNDING AND BONDING

A. In the service equipment, provide a separate (dedicated) ground bus.
1. Bond the ground bus with copper bus bar or cable, of equal or greater current carrying capacity of the service grounding conductor, to the neutral bar.
2. Resistance of neutral to ground shall not exceed 10 Ohms.
3. Connect the electric service grounding electrode conductors to the incoming metal water pipe system (when available, using a suitable ground clamp) and to a supplemental electrode such as a ground rod or ground .ring.
4. Provide grounding and bonding at the power company's metering equipment.
5. Provide access and cover for access to the ground grid and removable connections for testing the system.

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 required. 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 25 Ohms 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.

C. Provide an insulated equipment grounding conductor inside all conduits, raceways, surface raceways, gutters and wireways. The ground wire shall be bonded to each box to suitable lug, bus, or bushing. All bonding jumpers shall be routed inside conduit or raceway.

D. Provide an insulated isolated equipment grounding conductor in addition to the insulated equipment grounding conductor for all isolated grounding feeders, branch circuits, outlets and isolated grounding receptacles.

E. Provide all conduit terminating in switchgear, transformers, switchboards, panelboards and voice/data outlets with grounding bushings, where required, and ground wire extended to ground bus in equipment. Install grounding bushings where reducing washers are used and concentric and eccentric knock-outs are used.

F. Main bus and building grounding electrode conductor installation shall be witnessed by the Architect / Engineer.

G. Provide bonding to meet Regulatory Requirements.

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.

O. Do not use sheetmetal or self-drilling screws for bonding connections. Provide listed or approved connectors.

P. 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.

3.2 METAL FRAME OF BUILDING OR STRUCTURE

A. Effectively ground the building steel or structure per NEC 250-52 (2).

3.3 UFER GROUND

A. Provide a UFER ground at bottom of building slab per NEC 250.52 (3), bond to building steel.

3.4 MISCELLANEOUS REQUIREMENTS

A. Continuity of the equipment grounding system shall be maintained throughout the project. Equipment grounding jumpers shall be installed across conduit expansion fittings, liquid-tight flexible metal and flexible metal conduit, and other non-electrically continuous raceway fittings.

B. Equipment grounding conductors and grounding electrode conductor shall be stranded copper conductors and run in a suitable 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. Exterior Electrical Equipment Racks:
   1. Provide driven ground electrode.

E. 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. Grounding shall conform to ANSI/TIA/EIA 607(A) – Commercial Building Grounding and Bonding Requirements for Telecommunications, National Electrical Code®, ANSI/NECA/BICSI-568 and manufacturer's grounding requirements as minimum. Bonding shall be of low impedance to assure electrical continuity between bonded elements.
   1. MDF Closets Telecommunications Main Ground Bar (TMGB): Provide Erico #EGBA14424MM ground bar, 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 nearest electrical switchboard or panelboard.
   2. IDF Closets Telecommunications Ground Bar (TGB): Provide Erico #EGBA14410FF ground bar mounted to the telecommunications plywood backboard. Provide one #6 AWG insulated ground conductor from ground bar to building steel and to ground bus of nearest electrical panelboard or switchboard.
   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, cabinets, frames, together and with #6 AWG insulated ground conductor to the local TMGB / TGB. Bond and ground equipment racks, housings, messenger cables, raceways, and rack-mounted conduit.
   6. Route TMGB – TGB ground conductor using the shortest, straightest, route practical with long radius curves.

7. All conduits terminating to cable trays, wireways, and racks shall be mechanically fastened. When connected to a cable tray or rack, it must be connected with ground bushings, wire bonded to the tray or rack, and grounded to the main building grounding system or IDF room grounding bar using #6 AWG copper.

F. Ground lighting fixture bodies to the conduit grounding system.

G. Bond receptacle ground to the box and conduit ground system, except where and insulated/isolated grounding receptacle or outlet is specified.

H. Ground connections to building steel, grounding electrodes and all underground connections shall be by thermal fusion (exothermic).

I. Provide OZ Type “BJ” bonding jumper at all expansion joints, points of electrical discontinuity or connections in conduit where firm mechanical bond is not possible, such as flexible connections, insulating couplings, etc.

J. Ground each lighting and power panelboard by connecting the grounding conductors to the grounding stud.

K. Ground each secondary dry-type transformer to the ground bus of the primary side panelboard. Provide a bonding jumper between the ground stud and the neutral. Ground transformer ground stud to ground ring if a ground ring is installed or the nearest structural steel member.

L. Bond every item of equipment served by the electrical system to the building equipment ground system. This includes, but is not limited to, switchboards, panelboards, disconnect switches, receptacles, cable trays, controls, fans, air handing units, pumps and flexible duct connections.

M. Ground each light pole, power distribution poles, and metal conduit stub-ups at each light pole base.

N. Ground all metal conduit including metal conduit used for bends and penetrations through concrete.

O. Bond hot water and cold water piping together at each domestic water heater.

3.5 MANHOLE AND/OR PULL BOX GROUNDING

A. Provide a driven ground rod and ground bond ring in each power and telephone manhole or pull box. Bond cable racks and medium voltage cable shields at splices and terminations, ductbank conduit ground bushings and all other metal components in manholes or pull box to the ground ring.

3.6 COORDINATION

A. General: Coordinate installation of grounding connections for equipment with equipment installation work.

3.7 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. True 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 should 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 05 27

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 05 33

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, Raco, 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 H_2O PVC Coating Adhesion Test Procedure for 200 hours. The PVC coated galvanized rigid conduit must bear the ETL Verified PVC-001 label to signify compliance to the adhesion performance standard.

C. The conduit shall be hot dip galvanized inside and out with hot galvanized threads.

D. A PVC sleeve extending one pipe diameter or two inches, whichever is less, shall be formed at every female fitting opening except unions. The inside sleeve diameter shall be matched to the outside diameter of the conduit.

E. The PVC coating on the outside of conduit couplings shall have a series of longitudinal ribs 40 mils in thickness to protect the coating from tool damage during installation.

F. Form 8 Condulets, ½-inch through 2-inch diameters, shall have a tongue-in-groove gasket to effectively seal against the elements. The design shall be equipped with a positive placement feature to ease and assure proper installation. Certified results confirming seal performance at 15 psig (positive) and 25 inches of mercury (vacuum) for 72 hours shall be available.

G. Form 8 Condulets shall be supplied with plastic encapsulated stainless-steel cover screws.

H. A urethane coating shall be uniformly and consistently applied to the interior of all conduit and fittings. This internal coating shall be a nominal 2 mil thickness. Conduit or fittings having areas with thin or no coating shall be unacceptable.

I. The PVC exterior and urethane interior coatings applied to the conduit shall afford sufficient flexibility to permit field bending without cracking or flaking at temperatures above 30°F (-1°C).

J. All male threads on conduit, elbows and nipples shall be protected by application of a urethane coating.

K. All female threads on fittings or conduit couplings shall be protected by application of a urethane coating.

L. Independent certified test results shall be available to confirm coating adhesion under the following conditions
   1. Conduit and condulet exposure to 150°F (65°C) and 95% relative humidity with a minimum mean time to failure of 30 days. (ASTM D1151)
   2. The interior coating bond shall be confirmed using the Standard Method of Adhesion by Tape Test (ASTM D3359).
   3. No trace of the internal coating shall be visible on a white cloth following six wipes over the coating which has been wetted with acetone (ASTM D1308).
   4. The exterior coating bond shall be confirmed using the methods described in Section 3.8, NEMA RN1. After these tests the physical properties of the exterior coating shall exceed the minimum requirements specified in Table 3.1, NEMA RN1.

M. Right angle beam clamps and U bolts shall be specially formed and sized to snugly fit

the outside diameter of the coated conduit. All U bolts shall be provided with plastic encapsulated nuts that cover the exposed portions of the threads.

N. All fittings, clamps, straps, struts, and hardware used with PVC coated conduit shall be PVC coated or 316 stainless steel

2.6 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 condulet 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 at directed by Architect and as recommended by roofing manufacturer and roof support manufacturer. Provide additional unistrut supports and accessories as required.

I. PVC coated conduit shall have all nicks and cuts to the protective coating repaired using manufacturer's approved touch-up material as recommended by manufacturer. Provide a minimum of two-wraps of 3M-50 type tape over touch-up.

J. Installation of the PVC Coated Conduit System shall be performed in accordance with the Manufacturer's Installation Manual. To assure correct installation, the installer shall be certified by Manufacturer to install coated conduit. Submit copies of training certification with submittal. Contractor shall coordinate installation with manufacturer's representative for field training and observation of installed PVC coated rigid galvanized conduit and fittings. Manufacturer's representative shall certify the installation is in accordance with manufacturer's installation instructions. Submit copies of installation certification prior to cover-up of underground installation.

K. All conduit terminations at locations including but not limited to, switchgear, pull boxes, outlet boxes, stub-up, and stub-outs:
   1. Provide insulated throat connectors for EMT conduits.
   2. Provide insulated bushing on all rigid conduit terminations.
   3. Provide locknuts inside and outside of all boxes and enclosures.
   4. Provide threaded type plastic bushing at all boxes and enclosures

L. In suspended ceilings, support conduit runs from the structure, not the ceiling system construction.
   1. Do not support from structural bridging.
   2. Do not support from metal roof deck.

M. Completely install each conduit run 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 pours.

O. Ream ends of conduits after cutting and application of cutting die to remove rough edges.

P. Install all above concrete slab conduits perpendicular or parallel to building lines in the most direct, neat and workmanlike manner.
   1. Cable Tension:
      a. 0.008 lb./cmil for up to 3 conductors, not to exceed 10,000 pounds.
      b. 0.0064 lb./cmil for more than 3 conductors, not to exceed 10,000 pounds
      c. 1000 lbs. per basket grip.
   2. Sidewall pressure: 500 lbs./ft.
   3. Conduit runs within the following limits of bends and conduit length between pull points shall not exceed the above installation pulling tension and sidewall pressure limits.
      a. Three (3) equivalent 90-degree bends: not more than fifty feet (50') between pull points.
      b. Two (2) equivalent 90-degree bends: not more than one hundred feet

(100') between pull points.

c. One (1) equivalent 90-degree bend: not more than one hundred fifty feet (150') between pull points.

d. Straight pull: not more than two hundred feet (200') between pull points.

4. Indicate sizes of conduits, wireway sections, and cable tray sections on the as-built drawings.
5. Hold horizontal and vertical conduits as close as possible to walls, ceilings and other elements of the building construction. Conduits shall be kept a minimum of 6 inches clear of roof deck / insulation, and 2 inches clear of above floor deck / insulation.
6. Install conduits to conserve building space and not obstruct equipment service space or interfere with use of space. Conduit shall not be routed on floors, paved areas or grade.
7. Where a piece of equipment is wired from a switch or box on adjacent wall, the wiring shall go up the wall from the box, across at or near the ceiling, and back down to the equipment. Wiring shall not block the walkway between wall and equipment.
8. Horizontal runs of conduit on exposed walls shall be kept to a minimum.
9. Conduit for mechanical / plumbing equipment installed outdoors shall be routed with the associated mechanical / plumbing pipe support rack system where practical, coordinate with Divisions 22 and 23.
10. Conduits installed in public areas, not concealed by architectural ceilings, shall be supported by galvanized steel channel racks to bottom of roof deck or floor deck. Conduits shall be grouped for neat workman-like appearance.

Q. Install expansion and deflection fittings and bonding jumpers on straight runs which exceed 200-feet, on center, and at 200-feet maximum, on center, on straight runs which exceed 400-feet, and where conduits cross building expansion joints.

R. Provide grounding bushings at concentric/eccentric knockouts or where reducing washers are used.

S. Run conduit to avoid proximity to heat producing equipment, piping surfaces with temperatures exceeding 104 degrees F., and flues, keeping a minimum of 13-inches clear.

T. Install conduit as a complete system, without conductors, continuous from outlet to outlet and from fitting to fitting. Make up threaded joints of conduit carefully in a manner to ensure a tight joint. Fasten the entire conduit system into position. A run of conduit between outlet and outlet, between fitting and fitting, or between outlet and fitting shall not contain more than the equivalent of four quarter bends, including those bends located immediately at the outlet or fitting.

U. Conceal conduit systems in finished areas. Conduit may be exposed in mechanical and electrical rooms, and where otherwise shown or indicated only. Run the conduit parallel and perpendicular to the structural features of the building and support with malleable iron conduit clamps at intervals as required by NEC or on conduit racks, neatly racked and bent in a smooth radius at corners.

V. Conduit bends shall be factory elbows or shall be bent using equipment specifically designed to bend conduit of the type used to maintain the conduit's UL listing. Conduit hanger spacing shall be 10 feet or less and as required by the NEC for all conduit. Beam clamp attachments to steel joist chords is prohibited. Beam clamps may only be used at beams, no exceptions. Connections to joists shall be made with galvanized channel extended between joist chords or with galvanized channel bearing on the vertical legs of joist chord angles.

W. Support conduit on galvanized channel, using compatible galvanized fittings (bolts, beam clamps, and similar items), and galvanized threaded rod pendants at each end of channel and secure raceway to channel and channel to structure. Where rod pendants are not used, channel supports are to be secured to structure at each end. Conduit supports are to be secured to structure using washers, lock washers, nuts and bolts or rod pendants; use of toggle bolt “wings” are not acceptable. Support single conduit runs using a properly sized galvanized conduit hanger with galvanized closure bolt and nut and threaded rod. Raceway support system materials shall be galvanized and manufactured by Kindorf, Unistrut, Superstrut, Caddy, or Spring Steel Fasteners, Inc. Provide chrome or nickel-plated escutcheon plates on conduit passing through walls and ceilings in finished areas. Do not support conduit from other conduit, structural bridging or fire rated ceiling system. Do not support more than one conduit from a single all-thread rod support. Provide electrical insulating sleeve or wrapping for aluminum conduit supported by zinc coated supports or fasteners. Channel supports shall have cut ends filed smooth. When installed outside of the building, or in areas subject to moisture, the cut ends shall be painted with ZRC galvanized paint or equivalent.

X. Terminate all motor connection conduits in mechanical room spaces with a floor pedestal and with “Tee” conduit at motor outlet height for flexible conduit.

Y. Where conduit is not embedded in concrete or masonry, conduit shall be firmly secured by approved clamps, half-straps or hangers. Tie wire and short pieces of conduit used as supports and or hangers are not approved.

Z. Where “LB” condulets are used, 2-inches and larger shall be type “LBD”.

AA. No more than 12 conduits containing branch circuits may be installed in junction boxes, pull boxes or gutters.

BB. Flexible metal conduit and liquid tight flexible metal conduit shall only be used for final connections from junction box to 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. Encase all underground conduits in concrete.
   a. Concrete shall be tinted red throughout with a ratio of 10 pounds of dye per yard of concrete unless prohibited by utility for utility conduits. Concrete encasement for utility installed conductors shall be as specified by the utility and comply with their standards and specifications. Where utility does not require but allows concrete encasement of conduits, provide concrete encasement as specified herein.
   b. Provide minimum 3-inch concrete encasement around conduits.
   c. Provide conduit spacers for parallel branch/feeder conduits.
   d. When prior written approval from Owner and Architect to omit concrete encasement of conduits below building slab is given, conduits either specified or approved in writing to be routed under building slab without concrete encasement for electrical branch circuits or voice / data / video / communications horizontal drops or outlets shall be installed 18 inches below finished floor and on select fill. All other conduits, including but not limited to electrical feeders, voice / data / video / communications vertical, riser, tie, trunk, or service cable conduits shall be installed 48-inches below finished floor and on select fill.
   e. Use suitable manufactured separators and chairs installed 4 feet on centers. Securely anchor conduit at each chair to prevent movement during backfill placement.
3. Install building voice / data / video / communications main service conduits and electrical service transformer primary and secondary conduits with top of concrete encasement minimum 48-inches below finished grade or pavement. Voice / data / video / communications conduits and electrical service primary conduits for utility owned electrical service transformers shall also comply with the respective utility company requirements and standards. All other underground conduits outside of building other than voice / data / video / communications main service conduits and electrical service transformer primary and secondary conduits shall have top of concrete encasement at 36 inches minimum below finished grade or pavement.
4. Provide two “caution” plastic tapes at 6-inches and 18-inches below finished slab, grade, or pavement; identify as specified in Section 26 05 00.
5. Conduits located outside building, provide magnetic locator tape at top of first compacted layer of backfill or concrete.
6. During construction, partially completed underground conduits shall be protected from the entrance of debris such as mud, sand, and dirt by means of conduit plugs. As each section of the underground conduit is completed, a testing mandrel with diameter ¼-inch smaller than the conduit, shall be drawn through each conduit. A brush with stiff bristles shall be drawn through until conduit is clear of particles of earth, sand, or gravel. Conduit plugs shall then be installed.
7. Utility underground conduit for Utility Company cable shall be installed per Utility Company standards, and their specifications for this project.
8. Concrete shall be Portland Cement conforming to ASTM-C-150, Type 1, Type III or Type V if specified. Cement content shall be sufficient to product minimum strength of 2,500 PSI.
9. Contractor shall stake out routing and location of underground conduits using actual field measurements. He shall obtain approval of the Owner and Architect before beginning trenching, horizontal drilling, and excavation.
10. Verify location and routing of all new and existing underground utilities with the Owner and Architect on the job site. Stake out these existing utilities so

that they will not be damaged. Stake out new utilities to provide coordination with other trades and with new and existing utilities, easements, property lines, restricted land use areas, and right-of-ways. Verify existing public utilities with Call811.

D. Conduit shown in concrete walls, floor or roof slab:
   1. PVC Coated Galvanized Rigid steel.

E. Conduits that penetrate concrete slab, or within 100 feet of cooling towers, or at designated corrosive locations.
   1. 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 encased in concrete. Unless shown otherwise, the type of conduit used shall not be mixed in any one underground conduit and shall be the size indicated on the drawings. The concrete encasement surrounding the underground conduit shall be rectangular in cross-section, having a minimum concrete thickness of 3-inches, except that conduit for 120V and above shall be separated from control and signal conduits by a minimum concrete thickness of 3-inches. Encasement concrete shall be tinted in red.

B. During construction, partially completed underground conduits shall be protected from the entrance of debris such as mud, sand, and dirt by means of conduit plugs. As each section of the underground conduit is completed, a testing mandrel shall be drawn through until each conduit is clear of particles of earth, sand, or gravel. Conduit plugs shall then be installed.

C. Furnish the exact dimensions and location of power underground conduit to be encased in time to prevent delay in the concrete work.

D. Conduit for service entrance underground conduits shall be as indicated on the drawings.

E. Primary power underground conduit shall be installed in accordance with utility company standards and the utility company specifications for this project.

3.5 TELECOMMUNICATIONS, LOW VOLTAGE AND EMPTY CONDUIT SYSTEM RACEWAYS

A. Conduit shall be installed in accordance with the specified requirements for conduit and with the additional requirements that no length of run shall exceed 100-feet for 1 inch or smaller trade sizes and shall not contain more than two 90-degree bends or the equivalent. Pull or junction boxes shall be installed to comply with these requirements. Provide plastic bushings at all conduit terminations. Provide a grounding bushing on each data and voice conduit.

B. 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 05 35

ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART 1 – GENERAL

1.1 WORK INCLUDED

A. Electrical connections as required and scheduled, and as specified.

1.2 RELATED WORK

A. Refer to other Divisions for specific individual equipment electrical requirements.

1.3 QUALITY ASSURANCE

A. UL Label: Products shall be UL listed to the extent possible.

PART 2 – PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. General: For each electrical connection indicated, provide a complete assembly including, but not limited to, pressure connectors, terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, cable ties, solderless wire nuts, and other items and accessories needed to complete splices and terminations.

B. Raceways: Refer to related sections.

C. Conductors and Connectors: Refer to related section. Conductors at equipment terminations shall be copper.

D. Terminals: Provide electrical terminals as indicated by the terminal manufacturer for the application.

PART 3 – EXECUTION

3.1 INSTALLATION OF ELECTRICAL CONNECTIONS

A. General: Install electrical connections as shown, in accordance with applicable portions of the NECA Standard of Installation, and industry practices.

B. Conductors: Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Where possible, match conductors of the electrical connection for interface between the electrical supply and the installed equipment.

C. Splice Insulation: Cover splices with electrical insulation equivalent to, or of a higher rating than, insulation on the conductors being spliced.

D. Appearance: Prepare conductors by cutting and stripping covering, jacket, and insulation to ensure a uniform and neat appearance where cables and wires are terminated.

E. Routing: Trim cables and wires to be as short as practical. Arrange routing to facilitate inspection, testing, and maintenance.

F. Motor Connections: Where possible, terminate conduit in conduit boxes at motors. Where motors are not provided with conduit boxes, terminate the conduit in a suitable condulet, and make motor connections. Conduit passing through the housing on connected equipment shall pass through a cleanly cut hole protected with an approved grommet. For 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” condulet below the enclosure’s bottom elevation. Provide conduit from the condulet up to the enclosure bottom horizontal surface for electrical connection.

H. Identification: Refer to Electrical General Provisions for identification of electrical power supply conductor terminations with markers approved as to type, color, letter and marker size by the Architect. Fasten markers at each termination point, as close as possible to each connecting point.

I. Equipment and Furnishings: Refer to other Divisions. Coordinate power and control provisions shown for equipment and furnishings with the provisions required for the furnished equipment and furnishings. Where the power and control requirements are less than or equal to those specified, modifications to power and control provisions shall be made at no cost as a part of coordination. Where power and control requirements are in excess of those shown, notify the Architect in writing of the requirements.

J. Elevators and Escalators, and Wheelchair Lifts: Refer to Other Divisions. Coordinate power and control provisions shown with the provisions required for the furnished equipment. Where the power and control requirements are less than or equal to those specified, modifications to power and control provisions shall be made at no cost as a part of coordination. Where power and control requirements are in excess of those shown, notify the Architect in writing of the requirements. Provide lockable disconnect switches for main power, control power, lighting power, etc. as required by the NEC and all local codes. Provide all necessary means of two-way communication for emergency phones.

END OF SECTION

SECTION 26 05 37

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 05 40

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 05 50

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 08 00

ELECTRICAL AND LIFE SAFETY SYSTEMS TECHNICAL COMMISSIONING REQUIREMENTS

PART 1 – GENERAL

1.1. RELATED DOCUMENTS

1.1.1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.1.2. 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

1.2.1. The purpose of this Section is to define responsibilities in the Commissioning Process. Other electrical system testing is required under other Division 26 Specification Sections. National Electrical Installation Standards (NEIS) NECA 90-2004, "Recommended Practice for Commissioning Building Electrical Systems", 27th Volume of the NEIS Series, provides additional guidance for the commissioning of electrical systems.

1.2.2. 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 are provided separately and coordination is detailed in Division 01. Division 26 and 28 Contractors shall be familiar with all parts of Division 01, the General Commissioning Requirements 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.

1.2.3. Electrical Testing Agency (ETA)

1.2.3.1. The Contractor shall retain an independent Electrical Testing Agency (ETA). Their specific testing responsibilities are delineated in individual technical sections within Division 26. This generally requires checking and testing of the electrical power distribution equipment per National Electrical Testing Association (NETA) Acceptance Testing Standards (ATS).

1.2.3.2. Attend, as needed, Pre-Commissioning Meeting(s), Pre-Installation Meeting(s), and other Project meetings scheduled by the Contractor, Owner or CxA to facilitate the Commissioning process.

1.2.3.3. Obtain all required manufacturer's data to facilitate tests.

1.2.3.4. Provide assistance to the CxA in preparation of the specific System Verification Checklists (SVC) and Functional Performance Test procedures.

1.2.3.5. Generally, the ETA shall provide their standard forms to document the NETA tests to be incorporated into the System Verification Checklists and Functional Performance Test records.

1.2.3.6. The ETA shall assist the Contractor in completing required SVC information such as relay settings, protective overload settings, and equipment ratings utilizing the protocols in the Commissioning Plan.

1.2.3.7. Perform and clearly document all completed Start-up and system operational checkout procedures, providing a copy to the Contractor.

1.2.3.8. Clearly indicate any deficiencies identified during testing and add to an action list for resolution and tracking. The field technicians shall keep a running log of events and issues.

1.2.3.9. Provide skilled technicians to execute testing. Ensure that they are available and present during the agreed-upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem solving.

1.2.4. Electrical systems to be commissioned include the following:

1.2.4.1. Unit Substations / Electrical Switchboards

1.2.4.2. Secondary Normal Power Distribution

1.2.4.3. Emergency / Standby Power Distribution

1.2.4.4. Branch Power Distribution and Components

1.2.4.5. Emergency Generators and Paralleling Switchgear

1.2.4.6. Uninterruptible Power Supplies (UPS)

1.2.4.7. Lighting Controls - Occupancy Sensors (25% greater than 25 sensors installed, 100% less than 25 sensors installed)

1.2.4.8. Lighting - Daylight Controls (100%)

1.2.4.9. Lighting - Time Switch Controls (100%)

1.3. DEFINITIONS

1.3.1. Refer to Division 01: General Commissioning Requirements for definitions.

1.4. SUBMITTALS

1.4.1. 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.

1.4.1.1. Shop drawings and product submittal data related to systems or equipment to be commissioned.

1.4.2. 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.

1.4.3. Where installation testing may be performed in a progressive manner (i.e. grounding systems, insulation resistance, 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.

1.4.4. Contractor shall provide Owner 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, Functional Performance Test Procedures, Control Drawings, and details of Owner-Contracted tests.

1.4.5. Contractor shall provide any additional documentation needed to complete the requirements of the Commissioning Process

1.4.5.1. Factory Performance Test Reports: Review and compile all factory performance data to assure that the data is complete prior to executing the FPTs.

1.4.5.2. Incorporate manufacturer's initial energizing / startup procedures with System Verification Checklists.

1.4.5.3. Final Electrical Testing Agency (ETA) Reports documenting all NETA requirements indicated in the Project Documents

1.4.5.4. Completed equipment Start-up certification forms along with the manufacturer's field or factory performance and Start-up test documentation.

1.4.5.5. Operating and Maintenance (O&M) information per the requirements of the Technical Specifications and Division 01 requirements.

PART 2 - PRODUCTS

2.1. GENERAL

2.1.1. 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.

2.1.2. Refer to the General Commissioning Requirements for other work products related to the Commissioning Process

2.1.3. 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

2.2.1. The Contractor shall provide all specialized tools, test equipment and instruments required to execute Start-up, checkout, and testing of equipment.

2.2.2. 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.

PART 3 - EXECUTION

3.1. CONSTRUCTION PHASE

3.1.1. 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.

3.1.2. 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.

3.1.3. Provide manufacturer's data sheets and shop drawing submittals of equipment.

3.1.4. 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.

3.1.4.1. 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.

3.1.4.2. 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.

This information and data request may be made prior to normal submittals.

3.1.5. With input from the Lighting Controls, PCMS vendors and A/E, clarify the operation and control of commissioned equipment in areas where the Specifications, control drawings, or equipment documentation are not sufficient for writing detailed test procedures.

3.1.6. 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.

3.1.7. 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.

3.1.8. 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.

3.1.9. 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.

3.1.10. 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.

3.1.11. 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).

3.1.12. Provide training of the Owner's operating personnel as specified.

3.1.13. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.

3.2. WARRANTY PHASE

3.2.1. Execute seasonal or deferred tests, witnessed by the CxA and Owner, according to the Specifications.

3.2.1.1. Complete deferred tests as part of this Contract during the Warranty Period. Schedule this activity with the Owner.

3.2.2. 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

3.3.1. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

3.3.2. All installation shall be in accordance with the Project Documents.

3.4. TRAINING

3.4.1. Refer to the individual section of this Specification for specific training requirements on each system.

3.4.1.1. Refer to the General Commissioning Requirements and Division 01 of the Project Specifications for overall training requirements related to the Commissioning process and this project.

SECTION 26 09 25

ELECTRICAL CONTACTORS

PART 1 – GENERAL

1.1 WORK INCLUDED

A. Miscellaneous electrical contactors as shown, required, scheduled, and specified.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Provide products produced by one of the following:
Schneider Electric - Square D
ABB-General Electric
Siemens

2.2 CONTACTORS

A. Provide contactors as shown, required, and specified. The number of poles, ampere-ratings, and pole arrangements shall be as required. Contactors shall conform to the following:
1. Rated for continuous duty at full rated current in an unventilated enclosure. Eight-hour duty ratings are not acceptable.
2. Contacts shall be readily replaceable, self-aligning, silver alloy.
3. Load contactors shall be rated for not less than 30A continuous rating. Auxiliary contacts shall be rated for not less than 10 amperes.
4. Contactors rated for lighting and mixed loads shall have an interrupting capacity of 150% of their continuous duty rating.
5. Contactors shall be capable of successfully handling inrush currents at 20 times rating.
6. Provide a minimum of two spare load contacts on each individual contactor rated 60A or less for future use.

B. Electrically-held Devices shall conform to the following:
1. AC operated units shall have laminated low loss electrical steel core pieces with machine ground pole faces and shading coils.
2. Units rated at 300A and above shall have DC operating coils and include the necessary rectifier for the AC/DC operation.
3. Normally open contactors shall be spring-loaded open and magnetically closed.
4. Contactors for emergency lighting or power shall be normally closed.

C. Controls: Individual contactors operated by automatic controls shall have 30.5mm HAND-OFF-AUTOMATIC switches, otherwise provide HAND-OFF switches. Contactor controls shall be mounted in the contactor enclosure cover. Contactors serving receptacle loads controlled by local switching shall not have Hand-Off-Auto nor Hand-Off switching.

D. Control Power. Provide dedicated 120-volt circuit for contactor control power and indicator pilot lights. Do not use same circuit feeding load.

E. Enclosure:

1. Contactors and control enclosures installed in indoor locations shall be NEMA 1 heavy-duty enclosures unless shown otherwise.
2. Contactors and control enclosures installed at kitchen and food preparation locations, hose down areas, cooling towers, exterior locations, in greenhouses, and in other corrosive areas shall be NEMA 4X, stainless steel.

F. Minimum interrupting rating shall be 35KAIC.

PART 3 – EXECUTION

3.1 INSTALLATION OF MISCELLANEOUS ELECTRICAL CONTROLS

A. Provide electrically held contactors, with line side wiring complete, in accordance with the National Electrical Code and manufacturer's recommendations.

B. Fuses: Install fuses where coil control power is fed from line side of contactor.

C. Adjustment: Adjust operating mechanisms for free mechanical movement.

D. Coordinate contactor control and operation requirements with the Building Management Control System.

E. Identify each contactor as specified in Section 26 05 00.

F. Contactors shall not be installed above ceiling and shall be readily accessible. Locate contactors in same room as panelboard serving the load unless otherwise indicated.

3.2 INTERIOR AND EXTERIOR LIGHTING CONTROL

A. Parking lot lighting, building mounted exterior lighting, and exterior signage shall be controlled by separate lighting contactors by the specified Building Management and Control System. Interior lighting as noted on the plans shall be controlled as noted on the plans and as specified by the Building Management and Control System. Contractor shall circuit all systems to be controlled by the Building Management and Control System through contactors compatible with system controls and shall ensure the control and operation of lighting control system is complete.

B. Where control is a three-wire momentary control signal, provide control interface to operate electrically held 2-wire control contactors.

C. Provide normally closed contactors for emergency lighting and power circuits where contactors are indicated or required.

D. Provide normally closed contactors for circuits controlled by "emergency power off" or teacher control switches in science classrooms, computer labs, and vocational instructional areas.

E. Exterior lighting shall be controlled by the Building Management Control System, with local BMCS manual override for both "ON" and "HIGH" settings.

END OF SECTION

SECTION 26 09 28

DIGITAL LIGHTING CONTROLS – CY-FAIR ISD

PART 1 – GENERAL

1.1 INTRODUCTION

A. The work covered in this section is subject to all of the requirements in the General Conditions of the Specifications. Contractor shall coordinate all of the work in this section with all of the trades covered in other sections of the specification to provide a complete and operable system.

B. Contractor shall provide to the digital lighting control equipment manufacturer all quantities for system including but not limited to room controllers, occupancy sensors, button stations, photocells, emergency lighting controllers, and wire lengths for room controller communications bus.

C. Contractor shall demonstrate to the Owner, the complete successful operation of system including but not limited emergency lighting operation. Demonstration shall occur a minimum of 30 days prior to contract schedule completion date. Installing electrical contractor shall replace any failed material during warranty period of one year at no additional cost to the Owner.

D. Refer to the drawings and other specifications in Division 23 and 26 regarding lighting controls for exterior lighting and other interior areas indicated for control by the Building Management Control System (BMCS) or other means other than the digital lighting controls specified in this section.

E. Factory startup and commissioning for substantial completion, 90-day verification re-commissioning, and 11-month close-out commissioning shall be provided.

1.2 QUALITY ASSURANCE

A. Component Pre-testing: All components and assemblies are to be factory pre-tested and burned-in prior to installation.

B. NEC Compliance: Comply to NEC as applicable to electrical wiring work.

C. NEMA Compliance: Comply with applicable portions of NEMA standards pertaining to types of electrical equipment and enclosures.

1.3 SYSTEM DESCRIPTION & OPERATION

A. The lighting control system as defined under this section covers the following equipment for local room or local area networks only. Building wide network equipment is not required and shall not be provided unless those capabilities are inherent to the base components required or specified for local room controls only.
   1. Digital Room Controllers – Self-configuring, digitally addressable relay controllers with 0-10-volt dimming control for lighting and single relay application-specific plug load controllers when plug load control is specified or required.
   2. Digital Occupancy Sensors – Self-configuring, digitally addressable and calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.
   3. Digital Switches – Self-configuring, digitally addressable pushbutton switches,

dimmers, and scene switches with two-way active infrared (IR) communications.

4. Digital Photosensors – If Code required, single-zone closed loop and multi-zone open loop daylighting sensors with two-way active infrared (IR) communications that can provide switching or dimming control for daylight harvesting.
5. Configuration Tools – Handheld remote for room configuration provides two-way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away. Unit to have Organic LED display, simple pushbutton interface, and allow send and receive of room variables and store of occupancy sensor settings.
6. Emergency Lighting Control Unit (ELCU) – allows a standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building.
7. DLM Lighting control system components shall have the capability to be easily expanded in the future to building wide network functionally using all of the following topologies: a fully wired network.

B. Lighting controls and automation for exterior lighting and interior areas not controlled by the system specified in this section shall be as required and as specified by other specification sections in Division 23, and 26.

C. Power and communications for lighting controls provided shall be wired. Use of batteries or wireless communications is prohibited. Dimming control wiring shall not be installed with any line voltage power wiring conduits.

1.4 SUBMITTALS

A. Submit the specification line-by-line compliance review, shop drawings, and the product data specified below under one cover as a complete submittal.
   1. Specification compliance review: refer to Electrical Shop Drawings specification section for instructions and additional information.
   2. Shop Drawings:
      a. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed (standard diagrams will not be accepted).
      b. Scale drawing for each area showing exact location of each sensor, room controller, and digital switch.
   3. Product Data: Catalog sheets, specifications and installation instructions.
      a. Include data for each device which:
      b. Indicates where sensor is proposed to be installed.
      c. Prove that the sensor is suitable for the proposed application.

1.5 WARRANTY

A. Wattstopper Digital Lighting Management (DLM) control products: Provide a five-year complete manufacturer’s warranty on all products to be free of manufacturers’ defects.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. WattStopper (Legrand North America, LLC)
   1. System: Digital Lighting Management (DLM). No Substitutions.

2.2 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR SYSTEM

A. Ceiling mounted (or where specifically indicated or required to be wall mounted to suit installation); passive infrared (PIR), ultrasonic, or dual technology (passive infrared and ultrasonic) digital occupancy sensor. Furnish the system which accommodates the square-foot coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors and accessories which suit the lighting and electrical system parameters.

B. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:
   1. Digital calibration and pushbutton programming for the following variables:
      a. Sensitivity – 0-100% in 10% increments
      b. Time delay – 1-30 minutes in 1-minute increments
      c. Test mode – Five second time delay
      d. Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.
      e. Walk-through mode
      f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
   2. One or two RJ-45 port(s) for connection to DLM local network.
   3. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.
   4. Device Status LEDs including:
      a. PIR Detection
      b. Ultrasonic detection
      c. Configuration mode
      d. Load binding
   5. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
   6. Manual override of controlled loads.

C. Units shall not have any dip switches or potentiometers for field settings.

D. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration shall be required.

E. WattStopper product numbers: LMPX, LMDX, LMPC, LMUC, LMDC, LMDW

2.3 DIGITAL WALL SWITCHES

A. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration; grey, compatible with building standard stainless-steel wall plates with decorator opening. Wall switches shall include the following features:
   1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
   2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
   3. Red configuration LED on each switch that blinks to indicate data transmission.
   4. Blue Load/Scene Status LED on each switch button with the following characteristics:
      a. Bi-level LED

b. Dim locator level indicates power to switch
c. Bright status level indicates that load or scene is active

5. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.

B. Two RJ-45 ports for connection to DLM local network.

C. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required to achieve multi-way switching.

D. The following switch attributes may be changed or selected using a wireless configuration tool:
1. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
2. Individual button function may be configured to toggle, ON only or OFF only.
3. Individual scenes may be locked to prevent unauthorized change.
4. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
5. Ramp rate may be adjusted for each dimmer switch.
6. Switch buttons may be bound to any load on a room controller and are not load type dependent; each button may be bound to multiple loads.

E. WattStopper product numbers: LMSW-101, LMSW-102, LMSW-103, LMSW-104, LMSW-105, LMSW-108, LMDM-101.

2.4 ROOM CONTROLLERS

A. Room Controllers automatically bind the room loads to the connected devices in the space without commissioning or the use of any tools. Room Controllers shall be provided to match the room lighting load and control requirements. The controllers shall be simple to install and shall not have dip switches, potentiometers or require special configuration. The control units shall include the following features:
1. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
2. Simple replacement – Using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf unit without requiring any configuration or setup.
3. Device Status LEDs to indicate:
a. Data transmission
b. Device has power
c. Status for each load
d. Configuration status
4. Quick installation features including:
a. Standard junction box mounting
b. Quick low voltage connections using standard RJ-45 patch cable
5. Plenum rated
6. Manual override and LED indication for each load
7. Dual voltage (120/277 VAC, 60 Hz)
8. Zero cross circuitry for each load.

B. ON/OFF/Dimming enhanced Room Controllers shall include:
1. Real time current monitoring
2. One, two or three relay configuration
3. Efficient 250 mA switching power supply
4. Four RJ-45 DLM local network ports.

5. One 0-10-Volt analog output per relay for control of compatible LED drivers.
6. The following dimming attributes may be changed or selected using a wireless configuration tool:
    a. Establish preset level for each load from 0-100%
    b. Set high and low trim for each load
7. Discrete model listed for connection to receptacles, for occupancy-based control of plug loads within the space.
    a. One relay configuration only
    b. Automatic-ON/OFF configuration
8. WattStopper product numbers: LMRC-211, LRMC-212, LRMC-213, LMPL-201,

2.5 DIGITAL PHOTOSENSORS

A. Digital photosensors work with room controllers to provide automatic switching or dimming daylight harvesting capabilities for any load type connected to a room controller. Closed loop photosensors measure the ambient light in the space and control a single lighting zone. Open loop photosensors measure incoming daylight in the space and are capable of controlling up to three lighting zones. Photosensors shall be interchangeable without the need for rewiring.

B. Digital photosensors include the following features:
1. An internal photodiode that measures only within the visible spectrum and has a response curve that closely matches the photopic curve. The photodiode shall not measure energy in either the ultraviolet or infrared spectrums. The photocell shall have a sensitivity of less than 5% for any wavelengths less than 400 nanometers or greater than 700 nanometers.
2. Sensor light level range shall be from 1-10,000 footcandles (fc).
3. The capability of switching one-third, one-half or all lighting ON and OFF, or raising or lowering lighting levels, for each controlled zone, depending on the selection of room controller(s) and load binding to room controller(s).
4. For switching daylight harvesting, the photosensor shall provide a deadband or a separation between the “ON Setpoint” and the “OFF Setpoint” that will prevent the lights from cycling after they turn off.
5. For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a user-selectable minimum level.
6. Optional programmable wall switch override to allow occupants to reduce lighting level to increase energy savings or raise and lower lighting levels for a selected period of time or cycle of occupancy.
7. Infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.
8. Red configuration LED that blinks to indicate data transmission.
9. Blue status LED indicates test mode, override mode and load binding.
10. Recessed switch to turn controlled load(s) ON and OFF.
11. One RJ-45 port for connection to DLM local network.
12. An adjustable head and a mounting bracket to accommodate multiple mounting methods and building materials. The photosensor may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox.

C. Closed loop digital photosensors include the following additional features:
1. An internal photodiode that measures light in a 100-degree angle, cutting off the unwanted light from bright sources outside of this cone.
2. Automatic self-calibration, initiated from the photosensor, a wireless

configuration tool or a PC with appropriate software.
3. Automatically establishes setpoints following self-calibration.
4. A sliding setpoint control algorithm for dimming daylight harvesting with a “Day Setpoint” and the “Night Setpoint” to prevent the lights from cycling.
5. WattStopper Product Number: LMLS-400.

D. Open loop digital photosensors include the following additional features:
1. An internal photodiode that measures light in a 60-degree angle cutting off the unwanted light from the interior of the room.
2. Automatically establishes setpoints following calibration using a wireless configuration tool or a PC with appropriate software.
3. A proportional control algorithm for dimming daylight harvesting with a “Setpoint” to be maintained during operation.
4. WattStopper Product Number: LMLS-500.

2.6 ROOM OR AREA NETWORK

A. The DLM local network shall be a free topology lighting control physical connection and communication protocol. Digital room devices connect to the network using CAT 5e cables with RJ-45 connectors which provide both data and power to room devices. The DLM local network shall include:
1. Plug n’ Go automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
2. Simple replacement of any device in the network with a standard off the shelf unit without requiring commissioning, configuration or setup.
3. Push n’ Learn configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.
4. Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30-feet from a sensor, wall switch or IR receiver.

2.7 CONFIGURATIONS TOOLS

A. A configuration tool facilitates optional customization of DLM local networks and is used to set up open loop daylighting sensors. A wireless configuration tool features infrared communications, while PC software connects to each local network via a USB interface.

B. Features and functionality of the wireless configuration tool shall include:
1. Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30-feet.
2. High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.
3. Read, modify and send parameters for occupancy sensors, daylighting sensors, room controllers and buttons on digital wall switches.
4. Save up to nine occupancy sensor setting profiles and apply profiles to selected sensors.
5. Temporarily adjust light level of any load(s)on the local network and incorporate those levels in scene setting.
6. Adjust or fine-tune daylighting settings established during auto-commissioning and input light level data to complete commissioning of open loop daylighting controls.

C. WattStopper Product Numbers: LMCT-100, LMCI-100/LMCS-100

2.8 EMERGENCY LIGHTING

A. Emergency Lighting Control Unit – A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides normal ON/OFF/Dimming control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting to full bright ON until normal power is restored. Features include:
   1. 120/277 volts, 50/60 Hz., 20-amp driver rating
   2. Push to test button
   3. Auxiliary contact for remote test or fire alarm system interface.

B. WattStopper Product Numbers: ELCU-200.

PART 3 – EXECUTION

3.1 GENERAL INSTALLATION:

A. Install the work of this Section in accordance with manufacturer's printed instructions unless otherwise indicated. Provide a minimum of eight hours of on-site technical support for the coordination between the BMCS and the Wattstopper lighting controls. Ensure that the sequences of operation involving the BMCS are fully operational as specified and as required.

B. The installing contractor shall, prior to request of WattStopper factory start up and site commissioning, request an on-site meeting by including local factory representative, Owner and the general contractor, to assist in identification of any open-ended issues, thereby eliminating potential for delays and system commission interruptions.

C. Upon confirmation of progress by local factory authorities, the installing electrical contractor shall complete the start-up request form found in the WattStopper submittals, including any field changes from the contract documents. This is essential to facilitate substantial completion.

D. Room controllers shall be installed so that they are easily accessible for replacement or maintenance:
   1. Mount lighting control equipment to junction boxes as recommended by manufacturer.
   2. Where accessible ceiling heights are 10-feet AFF or less, room controllers shall be mounted on wall above local control switch location between 4 and 18-inches above the accessible ceiling and 2-inches clear of T-grid for above ceiling access.
   3. Where ceiling heights are above 10-feet, room controllers shall be mounted in an ancillary area above the ancillary area local control switch location with accessible ceiling of 10-feet or less. The high ceiling room controller shall be mounted adjacent to the lower ceiling room controller serving the ancillary area. The room controller for the high ceiling and ancillary area(s) may utilize the same room controller for each area if practical. If an ancillary area with low accessible ceiling area is not available, the room controller shall be installed in the same mechanical or electrical room as the electrical panel serving the lighting for that area and clearly labeled for its use and specific room that it controls.
   4. Smaller ancillary spaces not separated by doors that adjoin the larger space

do not require an additional control zone and shall be controlled with the larger adjoining space zone to reduce complexity.

E. Lighting controls shall meet the minimum requirements of all local codes in effect when project will be permitted with whatever exceptions deemed appropriate by the Owner. Wherever possible, minimize the complexity of the controls design to reduce the quantity and types of required sensor hardware, low voltage and line voltage wiring:
   1. Provide UL 924 emergency load control devices so that designated emergency interior light fixtures will be controlled ON/OFF/dimmed with adjacent area lighting and be brought to full-bright ON during power failure.
   2. Provide full floor area occupancy/vacancy sensor coverage wherever sensors are required.
   3. Provide 20-miniute time out delay where vacancy sensor control is provided or required.
   4. Provide 20-miniute or IECC maximum time out delay, whichever is shortest, where occupancy sensor control is provided or required.

F. Where daylighting controls are required or indicated they shall be fully automatic and full range dimming without local user override of the daylighting maximum light level set point or trim level. Local user override to dim to OFF shall be provided. A single photo sensor shall be interfaced with the room controller for each daylighting zone in an area and for each cardinal direction as required by the IECC, and as recommended by the lighting control system vendor.

G. Low voltage cabling installed above ceiling shall be supported every 5 feet at a minimum height of 3 feet above grid/ceiling but no closer than six inches below deck. Support system shall be ceiling wire attached to structure and clipped to ceiling support grid using Caddy drop wire securing clip #EC311. Cabling shall hang plumb to devices. Low voltage control wiring shall not be installed in the same raceway with line voltage wiring.

H. Renovation areas: Utilize existing wall box switch locations where line voltage wiring is removed and therefore can be utilized for low voltage control controls and control cabling unless shown or noted otherwise.

3.2 GENERAL SEQUENCES OF OPERATION

A. Areas with lighting that requires dimming: Manual ON shall initially bring the lighting level to lighting control system 80-percent set point but not lower than the minimal CFISD design standard-maintained foot-candela light level for the type of space served. Refer to CFISD's Electrical-Light Fixture standards for required maintained light levels. Contractor/vendor shall verify in the field with CFISD during the commissioning process typical acceptable light levels with all ceilings and walls installed and with final paint and finishes applied. It is CFISD's intention to adjust the trim points to a minimally acceptable light level and only adjust as needed due to light fixture lumen depreciation over the lifetime of the light fixtures. This will increase energy savings and extend the lifetime of the lighting system.

3.3 SEQUENCES OF OPERATION FOR SPECIFIC AREAS – REFER TO PLAN DETAILS FOR ADDITIONAL PROJECT SPECIFIC INFORMATION AND INSTRUCTIONS

A. CORRIDORS, STUDENT AND PUBLIC TOILETS/RESTROOMS ACCESSIBLE DIRECTLY FROM CORRIDORS, AND STAIRS: Includes all hallways and other egress pathways, including attached open access without doors, ancillary spaces

such as flex or collaboration spaces, student and public toilets/restrooms with or without a door open to corridor, (This does not include large areas open to the corridor pathway such as the adjoining seating areas of cafeteria, dining, commons, nor shall it include administrative staff toilets or restrooms).

1. Control through BMCS. BMCS occupied (turn ON) or unoccupied (turn OFF) state sent to DLM room controllers. Single DLM occupancy sensor and Hubbell key switch at each security keypad. Sensor to be used for auto ON only; sensor shall not turn corridor lights OFF. Dimming only if required for code required daylight harvesting.
2. Provide DLM occupancy sensor for body movement detection in corridors (maximum spacing 50-feet) to only turn all corridor lights ON. Provide hand motion sensor coverage in adjoining toilets/restrooms. Provide a DLM Hubbell momentary SPDT key switch next to each security keypad to manually turn corridor lights ON only (to be used if there is a DLM sensor failure or BMCS failure or if BMCS is in un-occupied state). Key switch shall not turn lights OFF. Any corridor occupancy sensor shall trigger all corridor DLM room controllers to turn lights ON at any time of day and will remain ON until a BMCS unoccupied state in which the lights shall turn OFF.
3. Corridors and their attached open access ancillary general use spaces and attached student/public toilets with or without corridor doors shall be grouped together. Do not switch general use ancillary spaces including student/public toilets with or without doors separately from the corridor that have direct access from an adjoining corridor.
4. Flex or collaboration spaces open to corridors shall be a separate dimming control zone but shall be grouped with the adjoining corridor's occupancy sensors and BMCS control for BMCS ON/OFF and sensor ON.
4. Corridor Hubbell SPDT key switch shall be located at each security system control keypad and shall have both load terminals shunted so that either up or down position will turn the lights ON. Label key switches as "CORRIDOR LTG ON".
5. Do not provide a fire alarm interface since sensors do not turn lights OFF.
6. DLM locations and quantities shall be kept to a minimum. Multiple corridors shall be grouped and controlled together as much as practical. Individual corridors do not require individual local controls. All corridors are either all on or all off.
7. Lighted display cases in corridors: Circuit with corridor lighting and with additional local manual line voltage key switch required by IECC identified as "CASE LTG".
8. Provide separate local switching or dimming for open ancillary flex spaces only if indicated.
9. No light switches in enclosed stairs. Switch and control all stair floor landings with the first-floor corridor except that one or more light fixture at each floor landing shall be controlled with that respective floor's corridor lighting. Do not provide sensors in stairs. Un-enclosed stairs shall be considered an extension of the adjoining corridor or space and shall share the adjoining corridor or space-controlled lighting line voltage circuits/zone. Do not provide a separate zone for un-enclosed stairs open to adjoining spaces.

B. INSTRUCTION AND ADMINISTRATIVE AREAS, OFFICES, LOUNGES/BREAK ROOMS, COPY/PRINT ROOMS, AND SIMILAR AREAS, STORAGE ROOMS THAT ARE 100 SQUARE FEET AND LARGER.

1. SEQUENCE: Provide vacancy sensor control (DLM system manual ON/OFF, auto OFF, DIM).
2. Instructional areas, classrooms, and large group instruction up to 99-person occupancy provide single zone dimming with DLM control at each entry door.

Provide additional zones if the room is equipped with room divider partitions.

3. Large Group Instruction over 100-person occupancy: Provide up to three dimming zones, one over the presentation display area, one over the seating area, and one for any other specialty lighting or enhanced zone functionality. Provide DLM system master control station only at the main entry door or near the presentation area. Provide entry station(s) at each entry door to provide ON/OFF general lighting.

C. SHOPS, KITCHEN, FOOD SERVING QUEUE, AND NATATORIUM

1. BMCS to interface with DLM room controllers for occupied/un-occupied state. Un-occupied state shall turn lights off. No occupant sensors for safety and security. Local DLM switches also function as a local override. No dimming
2. Kitchen/serving: Manual local DLM switches. Locate kitchen/serving switches in supervised locations for on/off control. No dimming (health code lighting requirement supersedes IECC).
3. Shops: Provide lighting with less than 0.6-Watts per square foot for IECC exception to not require lighting reduction controls or dimming.
4. Natatorium: Manual local DLM Hubbell momentary SPDT toggle (not keyed) switch in supervised location. Manual local DLM Hubbell momentary SPDT key switch at main entry door(s) and un-supervised locations. No dimming, no daylight harvesting for safety and security.

D. CAFETERIA, CAFETORIUM, GYMS, LIBRARY, STAGE, LOCKER ROOMS

1. BMCS to interface with DLM room controllers for occupied/un-occupied state. Un-occupied state shall turn lights OFF. No occupant sensors for safety and security. Local DLM switches also function as a local DLM override. Dimming only as required for light reduction, code required daylight harvesting, and as indicated on drawings.
2. Cafeterias and cafetorium's: DLM Hubbell SPDT key switches at cafetorium main entry. Dimming switches at main entry and on stage. Cafeterias require only one dimming zone. Cafetorium with stage: Provide up to three dimming zones, zoned from front of house to back of house.
3. School stage general lighting: General lighting for stages and platforms with proscenium curtains or wall dividers shall be controlled as a separate zone. Provide a separate zone for back-of-house stage access ramps. Provide DLM ON/OFF control for the stage general lighting at each entry/exit points to the stage. Provide ramp lighting ON/OFF DLM control at each end of the ramp. Verify zoning and switch locations with theatrical consultant drawings.
4. Elementary School Cafetorium Theatrical Track Lighting: Locate four ganged wall box 120-volt line voltage dimmer controls on stage at an accessible location, not obstructed by stage curtains, as indicated or as directed by CFISD.
5. Library: Manual DLM control located in supervised area (behind circulation desk or as directed by CFISD). Hubbell SPDT key switch at main entry door location as directed by CFISD. If dimming zones are provided locate dimming controls in a secured area (circulation desk). Key switch ON function shall force all lights to full bright.
6. Gyms: Manual DLM Hubbell SPDT key switch. Provide separate zones with Hubbell key switch to enable UIL competition light level for UIL Sports Lighting Standards. Label key switch for UIL competition light level control as court as "UIL COMPETITION ONLY".
7. Locker rooms: Occupancy sensors control for auto ON/OFF: Set sensors to full-bright on and 20-minute time delay off for safety and security. Manual ON/OFF with DLM Hubbell momentary SPDT key switches located at main entry doors and as directed by CFISD. Provide lighting in these areas with

less than 0.6-Watts per square foot for IECC exception to not require lighting reduction controls.

E. CLOSED-DOOR ADMINSITRATIVE OR PRIVATE TOILETS/RESTROOMS, DRESSING ROOMS, OTHER TOILETS/RESTROOMS WITH DOORS NOT DIRECTLY CONNECTED TO A CORRIDOR:
   1. SEQUENCE: Occupancy sensors (DLM system manual ON/OFF, automatic ON/OFF).
   2. Provide dual technology occupancy sensor control for automatic ON/OFF based on occupancy. Set occupancy time delay and sensitivity to device setting maximum for safety and security.
   3. Student/public restrooms with doors not connected to an adjacent egress corridor: Provide CFSID standard Hubbell momentary key switch at student and public toilets/restrooms entry door location for manual DLM ON/OFF.
   4. Private or administrative toilets/restrooms: Provide standard DLM ON/OFF switch for all other restrooms and dressing rooms with doors.

F. MECHANICAL, ELECTRICAL, PLUMBING, ELEVATOR, AND TECHNOLOGY ROOMS
   1. Use safety and security exceptions to IECC. No BMCS, no sensors, no lighting reduction, no DLM, no dimming. Use Wattstopper 12-hour 120/277-Volt digital wall box timer with manual on/off, time-out visual flash and audio alarm. Multiple switch locations at each entry door, wired in parallel as required. Program for 12 hours.

G. CUSTODIAL, JANITORIAL, STORAGE LESS THAN 100SF, UTILITY ROOMS, FREE STANDING REMOTE BUILDINGS (CONCESSION, PRESS BOX, TICKETING, ETC.)
   1. DLM vacancy sensor, no dimming except for press box viewing space.

H. BLACK BOX THEATRES

   1. Black box theatres shall be provided with standalone instructional lighting, lighting controls and emergency lighting typical of instructional areas and classrooms.

3.3 SEQUENCES OF OPERATION FOR SPECIFIC AREAS – REFER TO PLAN DETAILS FOR ADDITIONAL PROJECT SPECIFIC INFORMATION AND INSTRUCTIONS

A. CORRIDORS AND STAIRS: Includes all hallways and other egress pathways, including attached open access without doors, ancillary spaces such as flex or collaboration spaces, student and public toilets/restrooms with or without a door open to corridor, (This does not include large areas open to the corridor pathway such as the adjoining seating areas of cafeteria, dining, commons, etc.).
   1. Control through BMCS. BMCS occupied (turn ON) or unoccupied (turn OFF) state sent to DLM room controllers. Single DLM occupancy sensor and Hubbell key switch at each security keypad. Sensor to be used for auto ON only; sensor shall not turn corridor lights OFF. Dimming only if required for code required daylight harvesting.
   2. Provide DLM occupancy sensor for body movement detection (maximum spacing 50-feet) to only turn all corridor lights ON. Provide DLM occupancy sensors for hand movement detection in adjoining toilets/restrooms, group with corridor sensors. Provide a DLM Hubbell momentary SPDT key switch next to each security keypad to manually turn corridor lights ON only (to be used if there is a DLM sensor failure or BMCS failure or if BMCS is in un-occupied state). Key switch shall not turn lights OFF. Any corridor occupancy

sensor shall trigger all corridor DLM room controllers to turn lights ON at any time of day and will remain ON until a BMCS unoccupied state in which the lights shall turn OFF.

3. Corridors and their attached open access general use ancillary spaces including student/public toilets with or without corridor doors shall be grouped together. Do not switch general use ancillary spaces including student/public toilets with or without doors separately from the corridor that have direct access from an adjoining corridor. Flex/Collaboration spaces open to corridors shall be a separate dimming zone grouped with the adjoining corridor's occupancy sensors and BMCS ON/OFF control.
4. Corridor Hubbell SPDT key switch shall have both load terminals shunted so that either up or down position will turn the lights ON. Label key switches as "CORRIDOR LTG ON".
5. Do not provide a fire alarm interface since sensors do not turn lights OFF.
6. DLM locations and quantities shall be kept to a minimum. Multiple corridors shall be grouped and controlled together as much as practical. Individual corridors do not require individual local controls. All corridors are either all on or all off.
7. Lighted display cases in corridors: Circuit with corridor lighting and with additional local manual line voltage key switch required by IECC identified as "CASE LTG".
8. Provide separate local switching or dimming for open ancillary flex spaces only if indicated.
9. No light switches in enclosed stairs. Switch and control all stair floor landings with the first-floor corridor except that one or more light fixture at each floor landing shall be controlled with that respective floor's corridor lighting. Do not provide sensors in stairs. Un-enclosed stairs shall be considered an extension of the adjoining corridor or space and shall share the adjoining corridor or space-controlled lighting line voltage circuits/zone. Do not provide a separate zone for un-enclosed stairs open to adjoining spaces.

B. INSTRUCTION AND ADMINISTRATIVE AREAS, OFFICES, LOUNGES/BREAK ROOMS, COPY/PRINT ROOMS, AND SIMILAR AREAS, STORAGE ROOMS THAT ARE 100 SQUARE FEET AND LARGER.

1. SEQUENCE: Provide vacancy sensor control (DLM system manual ON/OFF, auto OFF, DIM).
2. Instructional areas, classrooms, and large group instruction up to 99-person occupancy provide single zone dimming with DLM control at each entry door. Provide additional zones if the room is equipped with room divider partitions.
3. Large Group Instruction over 100-person occupancy: Provide up to three dimming zones, one over the presentation display area, one over the seating area, and one for any other specialty lighting or enhanced zone functionality. Provide DLM system master control station only at the main entry door or near the presentation area. Provide entry station(s) at each entry door to provide ON/OFF general lighting.

C. SHOPS, KITCHEN, FOOD SERVING QUEUE, AND NATATORIUM

1. BMCS to interface with DLM room controllers for occupied/un-occupied state. Un-occupied state shall turn lights off. No occupant sensors for safety and security. Local DLM switches also function as a local override. No dimming
2. Kitchen/serving: Manual local DLM switches. Locate kitchen/serving switches in supervised locations for on/off control. No dimming (health code lighting requirement supersedes IECC).
3. Shops: Provide lighting with less than 0.6-Watts per square foot for IECC exception to not require lighting reduction controls or dimming.

4. Natatorium: Manual local DLM Hubbell momentary SPDT toggle (not keyed) switch in supervised location. Manual local DLM Hubbell momentary SPDT key switch at main entry door(s) and un-supervised locations. No dimming, no daylight harvesting for safety and security.

D. CAFETERIA, CAFETORIUM, GYMS, LIBRARY, STAGE, LOCKER ROOMS
1. BMCS to interface with DLM room controllers for occupied/un-occupied state. Un-occupied state shall turn lights OFF. No occupant sensors for safety and security. Local DLM switches also function as a local DLM override. Dimming only as required for light reduction, code required daylight harvesting, and as indicated on drawings.
2. Cafeterias and cafetorium's: DLM Hubbell SPDT key switches at cafetorium main entry. Dimming switches at main entry and on stage. Cafeterias require only one dimming zone. Cafetorium with stage: Provide up to three dimming zones, zoned from front of house to back of house.
3. School stage general lighting: General lighting for stages and platforms with proscenium curtains or wall dividers shall be controlled as a separate zone. Provide a separate zone for back-of-house stage access ramps. Provide DLM ON/OFF control for the stage general lighting at each entry/exit point to the stage. Provide ramp lighting ON/OFF DLM control at each end of the ramp. Verify zoning and switch locations with theatrical consultant drawings.
4. Elementary School Cafetorium Theatrical Track Lighting: Locate four ganged wall box 120-volt line voltage dimmer controls on stage at an accessible location, not obstructed by stage curtains, as indicated, or as directed by CFISD.
5. Library: Manual DLM control located in supervised area (behind circulation desk or as directed by CFISD). Hubbell SPDT key switch at main entry door location as directed by CFISD. If dimming zones are provided locate dimming controls in a secured area (circulation desk). Key switch ON function shall force all lights to full bright.
6. Gyms: Manual DLM Hubbell SPDT key switch. Provide separate zones with Hubbell key switch to enable UIL competition light level for UIL Sports Lighting Standards. Label key switch for UIL competition light level control as court as "UIL COMPETITION ONLY".
7. Locker rooms: Occupancy sensors control for auto ON/OFF: Set sensors to full-bright on and 20-minute time delay off for safety and security. Manual ON/OFF with DLM Hubbell momentary SPDT key switches located at main entry doors and as directed by CFISD. Provide lighting in these areas with less than 0.6-Watts per square foot for IECC exception to not require lighting reduction controls.

E. CLOSED-DOOR PRIVATE OR ADMINISTRATIVE TOILETS/RESTROOMS, DRESSING ROOMS, AND SIMILAR AREAS
1. SEQUENCE: Occupancy sensors (DLM system manual ON/OFF, automatic ON/OFF).
2. Provide dual technology occupancy sensor control for automatic ON/OFF based on occupancy. Set occupancy time delay and sensitivity to device setting maximum for safety and security.
3. Student/public restrooms with doors not connected to an adjacent egress corridor: Provide CFSID standard Hubbell momentary key switch at entry door location for manual DLM ON/OFF. Provide standard DLM switch for all other administrative or private restrooms and dressing rooms with doors.

F. MECHANICAL, ELECTRICAL, PLUMBING, ELEVATOR, AND TECHNOLOGY ROOMS

1. Use safety and security exceptions to IECC. No BMCS, no sensors, no lighting reduction, no DLM, no dimming. Use Wattstopper 12-hour 120/277-Volt digital wall box timer with manual on/off, time-out visual flash and audio alarm. Multiple switch locations at each entry door, wired in parallel as required. Program for 12 hours.

G. CUSTODIAL, JANITORIAL, STORAGE LESS THAN 100SF, UTILITY ROOMS, FREE STANDING REMOTE BUILDINGS (CONCESSION, PRESS BOX, TICKETING, ETC.)
1. DLM vacancy sensor, no dimming except for press box viewing space.

H. BLACK BOX THEATRES
1. Black box theatres shall be provided with standalone instructional lighting, lighting controls and emergency lighting typical of instructional areas and classrooms.

3.4 IDENTIFICATION FOR LIGHTING CONTROL SYSTEM EQUIPMENT

A. Above ceiling lighting control system equipment locators: Provide plastic tape machine typed name plate to bottom of ceiling T-grid below relay location. White letters on black background with ¼" high letters on ½" tall label for digital lighting module indicate as: DLM.

B. Room controller identification: Label each digital room controller with 120/277 Volt circuit (i.e., "HD-27") and room graphic name and number. Do not use architectural room name or number on drawings, use room graphic identification only.

C. All low voltage wiring shall have "WattStopper" printed on the wire jacket.

3.5 ATTIC STOCK

A. Provide a minimum of 2 or 5 percent of the project total, whichever is greater, of all other hardware components used.

B. Provide five configuration handheld remote tools for new facilities or three remote configuration handheld remote tools for renovation facilities.

3.6 FACTORY COMMISSIONING

A. The installing electrical contractor shall complete, prior to request of WattStopper factory start up and site commissioning, complete installation of all devices, their respective loads landed and confirmed operations, switches installed, and confirmed operation of each and every local room network. Upon completion of the installation, the system shall be commissioned by the manufacturer's factory authorized representative who will verify a complete fully functional system.

B. The installing electrical contractor shall provide a preliminary as-built drawing prior to commissioning. Drawing shall include room by room device ID's and locations of all WattStopper devices.

C. The factory commissioning shall include the following services. Programming of all button stations, configuration of all occupancy sensors and photocells. Verification of a complete working system.

D. Provide written or computer-generated documentation on the commissioning of the system including room by room description including:

1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
2. Sequence of operation, (e.g., manual ON, Auto OFF. etc.)
3. Load Parameters (e.g., blink warning, etc.)

E. The electrical contractor shall provide in writing, both the manufacturer and Owner, with 21-Owner business days written notice of the requested system startup and adjustment date.

F. The electrical contractor shall provide at least (1) journeyman electrician, familiar with the installation of the system, dedicated to assisting the factory start-up technician for the entire duration of the commissioning process.

G. Upon completion of the system commissioning the factory-authorized technician shall provide the proper training to the Owner's personnel on the adjustment and maintenance of the system.

H. Re-commissioning – After 90 days from occupancy re-calibrate all sensor time delays and sensitivities to meet the Owner's Project Requirements. Provide a detailed report to the Architect / Owner of re-commissioning activity.

I. Close-out commissioning - After 11-months from substantial completion, re-calibrate sensor time delays and sensitivities to Owner's Satisfaction at no additional cost to the Owner. Provide a detailed report to the Architect / Owner of re-commissioning activity.

END OF SECTION

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ULTRA HIGH EFFICIENCY K-RATED TRANSFORMERS

PART 1 – GENERAL

1.1 WORK INCLUDED

A. Copper-wound three-phase transformer exceeding US Department of Energy 2016 Efficiency Standards, with extremely low no load losses.
   1. Transformers shall be designed to an efficiency standard higher than NEMA Premium.

B. Load Mix: Transformer shall be UL 1561 Listed to feed a mix of equipment load profiles such as computers without derating or significant degradation of efficiency.

1.2 REFERENCES

A. FEDERAL REGISTER – US Department of Energy, Office of Energy Efficiency and Renewable Energy. 10 CFR Part 431. Energy Conservation Program for Commercial and Industrial Equipment: Energy Conservation Standards for Distribution Transformers; 2016 Standards

B. DOE Test Method For Measuring The Energy Consumption Of Distribution Transformers Under Appendix A To Subpart K Of 10 CFR Part 431.

C. Metering Standards:
   1. Computational algorithms per IEEE Std 1459-2000
   2. UL 916, UL 61010C-1 CAT III

D. IEEE-1100 – Recommended Practice for Powering and Grounding Sensitive Electronic Equipment
   1. IEEE Standard 1100 documents how typical transformers feeding electronic equipment produce substantially higher losses under electronic equipment load compared to under linear load, requiring derating.

E. LEED – Leadership in Energy and Environmental Design, U.S. Green Building Council.

F. ISO 9000:2000 – International Standards Organization - Quality Management System

G. ISO 14000:2004 – International Standards Organization - Environmental Management System

H. NFPA 70 - National Electrical Code (Latest Edition)

I. NEMA ST20-2014 - Dry-Type Transformers for General Applications

J. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment

K. US Department of Energy, 10 CFR Part 431, 2015. Energy Conservation Program: Energy Conservation Standards for Distribution Transformers; Final Rule.

L. IEEE C57.110-2008 – IEEE Recommended Practice for establishing transformer capability when feeding non-sinusoidal load currents.

M. ISO 17025 – International Standards Organization - General requirements for the competence of testing and calibration laboratories.

N. UL 1561 - Dry-Type General Purpose and Power Transformers.

1.3 SUBMITTALS

A. Submit product data including the following:
   1. Copy of ISO 14001:2004 Certification of manufacturing operation.
   2. Copy of ISO 9001:2000 Certification of manufacturing operation.
   3. Construction Details including enclosure dimensions, kVA rating, primary & secondary nominal voltages, voltage taps, BIL, unit weight
   4. Basic Performance characteristics including insulation class, temperature rise, core and coil materials, impedances & audible noise level, unit weight
   5. Inrush Current (typical 3 cycle recovery)
   6. Short Circuit Current data: Primary (Sym. O/P S/C) & Secondary (L-N/G S/C)
   7. Efficiency Data
      a. No load and full load losses per NEMA ST20
      b. Linear load Efficiency data @ 1/6 load
      c. Linear load efficiency data @ 1/4, 1/2, 3/4 & full load
      d. Linear Load Efficiency @ 35% loading tested per NEMA TP-2.
      e. Efficiency under specified K rating load profile at 15%, 25%, 50%, 75%, 100% of nameplate rating.
   8. Copy of Factory ISO 9001 documentation describing nonlinear load test program
      a. Meter and CT details including model, accuracy, serial numbers and calibration information.
   9. Copy of Linear & Nonlinear load test report for a representative 75kVA transformer
   10. 25 year Product Warranty Certificate

B. Description of manufacturer’s factory nonlinear load test program.
   1. In light of the significant degradation of transformer performance when feeding nonlinear load compared to linear load, it is mandatory that the manufacturer test the transformers under nonlinear load representative of real world load mix. Transformers that have not been subject to testing under nonlinear load will not be considered for this project due to the uncertainty related to their real world performance.
   2. Given the lack of a standard for testing transformers under nonlinear load, the manufacturer must have a nonlinear Load Test Program operating in the production environment that is audited and documented per quality standard ISO 9001.
   3. The nonlinear load bank shall consist of a phase-neutral loading with a specified K rating load profile, representative of a mix of typical commercial equipment.
   4. Meters and CTs shall both be revenue class accurate. CTs shall be operated within their approved accuracy loading range. Dual meters shall gather simultaneous primary and secondary energy and harmonic data. Meter and CT details including model, accuracy, serial numbers and calibration information.

5. Efficiency: Measurements shall be taken at multiple load levels and plotted to show compliance with specification and correlation to the designed efficiency curve.
6. Efficiency shall be determined purely by measurements using method and instrumentation per NEMA TP-2 Standard. Other methods are not acceptable.
7. Harmonic data including current and Voltage THD at the different load levels shall be included with the test report.

1.4 SPECIFICATION COMPLIANCE REVIEW

A. Mark up a complete copy of the specification section for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect/Engineer/Owner (Does Not Comply, Explanation:) Do not submit an outline form of compliance, submit a complete copy with the product data.

1.5 DELIVERY, STORAGE AND HANDLING

A. Store and protect products

B. Store in a warm, dry location with uniform temperature. Cover ventilation openings to keep out dust, water and other foreign material.

C. Handle transformers using lifting eyes and/or brackets provided for that purpose. Protect against unfavorable external environment such as rain and snow, during handling.

1.6 WARRANTY

A. Transformer shall carry a 25-year pro-rated warranty, which shall be standard for the product line.

1.7 INTERNATIONAL STANDARDS ORGANIZATION REGISTRATION OF MANUFACTURING PLANT

A. Registration to current ISO standard is required.

B. Independent annual audits are conducted.

C. Product shall be manufactured in registered facility

D. ISO 9001:2000 Registered – Quality Management System

E. ISO 14001:2004 Registered – Environmental Management System
1. Transformer manufacturing can produce significant emissions of volatile compounds and significant other waste. To minimize environmental impact, the transformer must the product of a manufacturing process that has been independently audited to comply with the ISO 14001:2004 Environmental Management System Standard, where strict quality control of raw material sourcing and construction techniques maximize product efficiency and minimize emissions and waste byproducts.
2. ISO 14001:2004 ensures that a facility has had an independent environmental

impact assessment of raw material sourcing and all manufacturing processes, and has implemented an independent annually audited program that minimizes environmental impact during manufacturing process and includes a strictly monitored continuous improvement program.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS/PRODUCT

A. Powersmiths E-Saver OPAL

B. Power Quality International (Z3 e-Rated)

C. Mirus - ULLTRA

2.2 TRANSFORMER SPECIFICATION

A. Minimum UL Listed and Labeled K-Rating: K7

B. Copper-wound, 3-phase, common core, ventilated, dry-type, isolation transformer built to NEMA ST20 and relevant NEMA, UL and IEEE standards; 200% rated neutral; 60Hz rated; Transformers 750 kVA and less, 600 volt primary and less, shall be UL Listed and bear the label. All terminals, including those for changing taps, must be readily accessible by removing a front cover plate. Windings shall be continuous with terminations brazed or welded. 10kV BIL.

C. Insulation System:
   1. Shall be NOMEX-based with an Epoxy Co-polymer impregnate for lowest environmental impact, long term reliability and long life expectancy
      a. Class: 220 degrees C
      b. Impregnate Properties for low emissions during manufacturing, highest reliability and life expectancy
      c. Epoxy co-polymer
      d. VOC: less than 1.65 lbs./gal (low emissions during manufacturing)
      e. Water absorption (24hrs @25C): less than 0.05% (superior insulation, longer life)
      f. Chemical Resistance: Must have documented excellent performance rating by supplier
      g. Dielectric Strength: minimum of 3200 volts/mil dry (for superior stress, overvoltage tolerance)
      h. Dissipation Factor: max. 0.02 @25C to reduce aging of insulation, extending useful life

D. Operating Temperature Rise: Maximum 115 degree C in a 40 degree C maximum ambient

E. Noise levels:
   1. 3dB Below NEMA ST-20
   2. Production Test every unit. Data to be available upon request.

F. Exceed minimum efficiency requirements of US Department of Energy, 10 CFR Part 431, April 18, 2013, Energy Conservation Program: Energy Conservation Standards for Distribution Transformers: Final Rule which takes effect January 1, 2016, and

comply with the table of maximum no Load Loses, efficiency requirements at 1/6 load, efficiency at 35% load per 10 CFR Part 431, and efficiency at 25% load under the transformer specified K-rating load profile.

G. Maximum losses and minimum efficiency under linear load conditions per Table 1.

Table 1
Max and Min Values for Losses and Efficiency for "High Efficiency" Transformers
Under K1 Linear and Specified K-Rating Nonlinear Loading

kVA Rating	No Load	16.5% Load				25% Load				35% Load			
		K1 Linear		Nonlinear		Linear		Nonlinear		K1 Linear		Nonlinear	
	Max Loss (kW)	Max Loss (kW)	Min Eff. (%)	Max Loss (kW)	Min Eff. (%)	Max Loss (kW)	Min Eff. (%)	Max Loss (kW)	Min Eff. (%)	Max Loss (kW)	Min Eff. (%)	Max Loss (kW)	Min Eff. (%)
15	0.054	0.066	97.38	0.067	97.36	0.082	97.86	0.085	97.78	0.109	97.97	0.117	97.82
30	0.091	0.112	97.79	0.113	97.77	0.138	98.19	0.144	98.12	0.183	98.29	0.200	98.13
45	0.124	0.152	98.00	0.154	97.97	0.187	98.36	0.197	98.28	0.248	98.45	0.276	98.28
75	0.181	0.221	98.24	0.225	98.22	0.273	98.56	0.288	98.49	0.362	98.64	0.404	98.48
112.5	0.245	0.300	98.41	0.305	98.38	0.370	98.70	0.393	98.62	0.490	98.77	0.555	98.61
150	0.303	0.370	98.53	0.377	98.50	0.457	98.80	0.486	98.72	0.605	98.86	0.688	98.71
225	0.410	0.501	98.67	0.510	98.64	0.619	98.91	0.659	98.84	0.820	98.97	0.937	98.82
300	0.509	0.622	98.76	0.636	98.73	0.769	98.99	0.829	98.91	1.018	99.04	1.194	98.88
500	0.741	0.906	98.91	0.928	98.89	1.119	99.11	1.213	99.04	1.482	99.16	1.754	99.01

H. Voltage Taps: For transformers 30kVA-300kVA, provide two 2-1/2% full capacity taps above and below nominal primary voltage. For transformers 15kVA and smaller as well as 500kVA and larger provide one 5% full capacity tap above and below nominal primary voltage.

I. Impedance: Between 3.0% and 6.0% unless otherwise noted.

J. Enclosure type: Ventilated NEMA 2; NEMA 3RX aluminum or stainless steel when located outdoors, or as indicated otherwise

K. Finish Color: Provide light gray ANSI-61 paint finish for transformers located outdoors. Provide manufacturer's standard paint finish color indoors.

L. Transformer Options:
1. Electrostatic Shield: Each winding is independently single shielded with a full-width copper electrostatic shield

M. Closed delta 120/240-Volt secondary, 3-phase, 4-wire with center tap neutral winding transformers:

1. KVA rating indicated shall be for balanced 3-phase loading. Center tap winding shall allow for a maximum nominal 70-percent of three-phase kVA rating for unbalanced single phase neutral connected 120/240-Volt loads. The center tap winding shall be individually rated or constructed at twice the capacity of each of the other delta connected windings. (Example: a 225kVA rated center tap transformer would consist of two 75-kVA windings and one 150-kVA center tap winding).

PART 3 – EXECUTION

3.1 INSTALLATION

A. General: Install transformers where shown, in accordance with the manufacturer's written instructions and industry practices to ensure that the transformers meet the specifications. Comply with requirements of NEMA and NEC standards, and applicable portions of NECA Standard of Installation, for installation of transformers. Transformers shall be floor mounted. Ceiling mounted transformers are not acceptable.

B. Dry-Type Transformer Mounting: Indoor, floor mount transformer on properly sized Amber/Booth Type RVD rubber-in-shear vibration isolators. Transformer enclosures shall make no contact with wall surfaces.

C. Conduit directly connected to transformer enclosures shall be flexible liquid tight conduit extending for a minimum of 18-inches and a maximum of 24 inches from transformer enclosure as measured along the conduit centerline. Include a ground wire, size in accordance with NEC, internal in each length of flexible conduit.

D. Grounding: Ground and bond transformers as a separately derived system unless noted otherwise, refer to NEC 250. Installation of bonding strap or bonding conductor between ground and neutral bus shall be witnessed by the Engineer prior to applying power and terminating secondary conductors.

E. Check for damage and loose connections.

F. Set the transformer plumb and level.

G. Provide Seismic restraints where required.

H. Coordinate all work in this Section with that in other sections.

I. Verify all dimensions in the field.

J. Adjust transformer secondary voltages to provide the required voltage at the loads.

3.2 TESTING

A. Insulation Tests: Before energizing, check transformer windings for continuity.

B. Winding Current: During initial no-load energizing, check current in each primary winding.

C. Tap Settings: Measure and record load current and voltage of transformers while

loaded to verify proper transformer tap settings.

D. Submittals: Furnish instruments and personnel required for tests. Submit four copies of certified test results to Engineer for review. Reports include transformer tested, date and time of tests, relative humidity, temperature, and weather conditions.

E. Performance Validation: To ensure that the products shipped to the job site meet this specification, provide on-site revenue class accurate efficiency and harmonic measurements of transformers once installed and operating at customer's site. Data shall be collected from primary and secondary sides of the transformer simultaneously on a synchronized cycle by cycle basis. The use of two discrete meters that are not synchronized is not acceptable. Sampling shall be of 10% of transformers on the project once installed and operating, as selected by customer. Submit a detailed report to the project engineer.

F. Identify non-compliant products to the engineer and replace at no cost to the Owner.

G. Notification: Notify Engineer in writing of any deviation from manufacturer's pre-shipment test data.

END OF SECTION

SECTION 26 24 13

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 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, 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, I^2t 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, I^2t settings, ground fault (where required), instantaneous trip, and short time trip. Solid state trip true RMS sensing, without fusible elements; 100-percent continuous current rating.
      b. Energy Reducing Maintenance System switch with local status indicator (ERMS).
      c. Shunt trip capability and wiring to terminal block for remote shunt trip switch wiring termination weather remote trip device is indicated or not.
   2. Fusible switches:
      a. Each switch shall have an individual door over the front, equipped with a voidable interlock that prevents the door from being opened when the switch is in the ON position unless the interlock is purposely defeated by activation of the voiding mechanism. All switches shall have externally operated handles.
      b. Fused switches 600 Amps and below, equipped for class J fuses.
      c. Fused switches 601 Amps and above shall be equipped with Class R or L rejection type fuse holders. Class RK1 or L of ampere rating and type as indicated on the plans suitable for application of the system.
      d. When required by the latest edition of the NEC or the AHJ, 1,200 Amp switches regardless of fuse size installed shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).

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, I^2t settings, ground fault (where required), instantaneous trip, and short time trip; 80-percent continuous current rating.
      b. 250 Amp and smaller: Solid state true RMS sensing with fixed current setting by rating plug or dial. Breaker shall have adjustable instantaneous trip function with short time tracking.
      c. 1,200 Amp frame circuit breakers regardless of trip shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).
   2. Fusible switches:
      a. Quick-make, quick-break units utilizing the double-break principle of circuit interrupting to minimize arcing and pitting and shall conform to the ratings shown.
      b. Individual door over the front, equipped with a voidable interlock that prevents the door from being opened when the switch is in the ON position unless the interlock is purposely defeated by activation of the

voiding mechanism. All switches shall have externally operated handles.

c. 600 Amps and below equipped for Class J fuses.

d. 601 Amps and above shall be equipped for Class R or L rejection type fuse holders.

e. When required by the latest edition of the NEC or the AHJ, 1,200 Amp fused switches regardless of fuse size installed shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).

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 24 14

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, 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, I^2t settings, ground fault (where required), instantaneous trip, and short time trip. Solid state trip true RMS sensing, without fusible elements; 100-percent continuous current rating.
    b. Energy Reducing Maintenance System switch with local status indicator (ERMS).
    c. Shunt trip capability and wiring to terminal block for remote shunt trip

switch wiring termination weather remote trip device is indicated or not.

2. Fusible switches:
   a. Each switch shall have an individual door over the front, equipped with a voidable interlock that prevents the door from being opened when the switch is in the ON position unless the interlock is purposely defeated by activation of the voiding mechanism. All switches shall have externally operated handles.
   b. Fused switches 600 Amps and below, equipped for class J fuses.
   c. Fused switches 601 Amps and above shall be equipped with Class R or L rejection type fuse holders. Class RK1 or L of ampere rating and type as indicated on the plans suitable for application of the system.
   d. When required by the latest edition of the NEC or the AHJ, 1,200 Amp switches regardless of fuse size installed shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).

C. Feeder and Branch Protective Devices 1,200 Amps and below shall be group mounted:
   1. Molded case circuit breakers:
      a. Greater than 250 Amp: Solid state true RMS sensing with adjustable: current, I^2t settings, ground fault (where required), instantaneous trip, and short time trip; 80-percent continuous current rating.
      b. 250 Amp and smaller: Solid state true RMS sensing with fixed current setting by rating plug or dial. Breaker shall have adjustable instantaneous trip function with short time tracking.
      c. 1,200 Amp frame circuit breakers regardless of trip shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).
   2. Fusible switches:
      a. Quick-make, quick-break units utilizing the double-break principle of circuit interrupting to minimize arcing and pitting and shall conform to the ratings shown.
      b. Individual door over the front, equipped with a voidable interlock that prevents the door from being opened when the switch is in the ON position unless the interlock is purposely defeated by activation of the voiding mechanism. All switches shall have externally operated handles.
      c. 600 Amps and below equipped for Class J fuses.
      d. 601 Amps and above shall be equipped for Class R or L rejection type fuse holders.
      e. When required by the latest edition of the NEC or the AHJ, 1,200 Amp fused switches regardless of fuse size installed shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).

PART 3 – EXECUTION

3.1 INSTALLATION, MAINTENANCE, AND MODIFICATION OF SWITCHBOARDS 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 Manufacture’s Operation and Maintenance Instructions for testing and periodic maintenance.

B. Torque all existing and new bus connections and tighten mechanical fasteners to manufacturer's specifications.

C. Install fuses, of ratings shown, in each new or modified fused switch.

D. Adjustment: Adjust operating mechanisms for free mechanical movement. Adjust circuit breaker time characteristic curves as directed by the OEM for coordination with downstream overcurrent devices.

E. Existing Indicating Instruments: Test and calibrate to original manufacturer's specifications. Replace batteries in existing digital instruments where batteries are required. Replace defective indicating instruments with new digital instruments. Provide new digital indicating instruments where indicated on the drawings.

F. Cleaning: Vacuum the interior of the existing 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 recommFeedended 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 24 16

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, I^2t 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 used third party hardware. Do not use power tools to secure panel hardware. Provide gray powder coat finish over a rust inhibitor.
   3. Equip with interior circuit directory frame, card, and clear plastic covering for panelboards.
   4. Panelboards located in kitchen preparation or natatorium areas shall have Type 316 stainless steel front, door, and trim with a NEMA 1 rating for the entire enclosure.
   5. Panelboards at exterior locations shall be NEMA 4X Type 316 stainless steel.
   6. Panelboards at hose down areas, cooling towers, in greenhouses, and other corrosive locations shall be NEMA 4X 316 stainless steel.
   7. Enclosure shall be for recessed or surface mounting as shown or as required.
   8. Enclosures shall be fabricated by the same manufacturer as panelboards to be enclosed. Multi-section panelboards shall have same physical dimensions.

PART 3 – EXECUTION

3.1 INSTALLATION OF PANELBOARDS AND ENCLOSURES

A. General: Install panelboards and enclosures, as shown, including electrical connections, in accordance with the manufacturer's written instructions, the requirements of NEC, NECA Standard of Installation, and industry practices. Circuit breakers shall be factory installed except for required field modifications due to actual site conditions.

B. Coordination: Coordinate installation of panelboards and enclosures with conductor and raceways installation work.

C. Anchoring: Anchor enclosures to walls and structural surfaces ensuring that they are

permanently and mechanically secured.

D. Directory Card: Provide a typed circuit directory card(s) upon completion of work. Directory card shall be of super heavy-weight index card stock, 110 lb, white. Directory shall include type of load (i.e.: receptacles, lighting, exhaust fan, etc.) and location (i.e.: Room 102, Office, etc.) Room number shall be identified as the actual graphics room number assigned to the space and not the room number identified on the Plans. Circuits with shunt trip shall be identified with the control circuit operating the shunt trip (i.e.: Kitchen Hood No. 2). Shunt trip breakers with common trip circuit shall be grouped in the panelboard (i.e.: circuits 1, 3, 5 and 7).

E. Fuses: Install fuses, of the ratings and class shown.

F. Circuit Arrangement: Branch circuits shall be arranged to provide the best possible phase balance, unless shown otherwise.

G. Panelboards not intended to be used as service entrance (SE) rated or for establishing a separately derived neutral system shall have the factory installed neutral to ground bonding screws and straps removed and disposed of.

H. Recessed or flush mounted panelboards: Terminate spare conduits in junction box 18-inches above accessible ceiling close to panelboard location. Label junction box cover as “not used” and include panel identification.
   1. Provide (3) 1-inch and (3) ¾-inch spare conduits above accessible ceiling to j-box from each panelboard section.
   2. Where recessed panelboard is located above another building floor, also provide (3) 1-inch and (3) ¾-inch conduits to j-box in ceiling space on floor below.

I. Conductors shall be bent neatly opposite the fuse switch or circuit breaker to which they are to be attached. Vertically installed conductors shall be neatly tie-wrapped. Conductors shall be connected in a neat and professional manner. Conductors brought in from the top or bottom of the cabinet shall be bent neatly opposite the fuse or circuit breaker to which they are to be attached. Each conductor shall be run along the full height of the panel and returned to the circuit breaker or fuse location to allow relocation of the conductor to any position along the bus. Panelboard shall be cleaned of all construction debris prior to substantial completion review. Neutral and grounding conductors shall be installed similar to the phase conductors.

J. Circuit breakers and conductors installed for SPD devices shall be located 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 24 25

ENCLOSED SWITCHES

PART 1 – GENERAL

1.1 WORK INCLUDED

A. Safety and disconnect switch work where required, scheduled, indicated, specified, and required. For switches indicated or rated above 1,200 Amps, provide switchboard construction as specified for switchboards.

B. UL Approved: Safety and disconnect switches shall have UL approval and the UL label.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Schneider Electric - Square D

B. ABB-General Electric Co.

C. Siemens

2.2 ENCLOSED SWITCHES

A. General: Provide heavy duty type, dead-front, sheet steel enclosed, surface-mounted safety switches of the type and size indicated. Safety switches shall be rated for the voltage of the circuit where they are installed. Safety switches used as motor disconnects shall be rated for the motor horsepower served.

B. The overcurrent protective device short circuit, coordination and arch flash studies performed by the overcurrent protective device manufacturer shall be used by the respective switchgear vendor(s) to select appropriate equipment, switchgear, and overcurrent protective device characteristics such as but not limited to: equipment bracing, AIC rating, circuit breaker frame size and trip settings, and fuse type/class. The appropriate equipment suitable and required by the studies for code compliance shall be included with the submittal data for review and provided at no additional cost to the Owner. The appropriate equipment recommended by the studies for enhanced selective coordination or enhanced arc flash energy reduction beyond code compliance shall be included with the submittal data for review and consideration purposes by the engineer.

C. Switch Mechanism:
   1. Safety switches shall be quick-make, quick-break type with permanently attached arc suppressor. Constructed so that switch blades are visible in the OFF position with the door open. The operating handle shall be an integral part of the box, not the cover. Switch shall have provision to padlock in the OFF position. Safety switches shall have a cover interlock to prevent unauthorized opening of the switch door when the switch mechanism is in the ON position, or closing of the switch mechanism when the switch door is open.
   2. Cover interlock shall have an override mechanism to permit switch inspection by authorized personnel. Current-carrying parts shall be constructed of high

conductivity copper with silver-plated switch contacts. Lugs shall be suitable for copper conductors and front removable.

D. Neutral: Provide safety switches with number of switched poles indicated. Where a neutral is present in the circuit, provide a solid neutral with the safety switch. Where a ground conductor is present in the circuit, provide a separate solid ground with the safety switch.

E. Auxiliary Contacts: Disconnect switches related to all smoke control fans shall have auxiliary contacts for fire alarm system monitoring of the position of the disconnect switch.

2.3 ENCLOSED SWITCHES WITH OVERCURRENT AND/OR GROUND FAULT PROTECTION

A. Overcurrent protective devices 1,200 Amps and below:
   1. Where switch is intended as a building service disconnect provide solid neutral and ground bus and service entrance SE rating.
   2. Molded case circuit breakers:
      a. Greater than 800 Amp: Solid state true RMS sensing with adjustable: current, I^2t settings, ground fault (where required), instantaneous trip, and short time trip; 80-percent continuous current rating.
      b. 800 Amp and smaller: Solid state true RMS sensing with fixed current setting by rating plug or dial. Breaker shall have adjustable instantaneous trip function with short time tracking.
      c. 1,200 Amp and larger frame circuit breakers regardless of trip shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).
   3. Fusible switches:
      a. Quick-make, quick-break units utilizing the double-break principle of circuit interrupting to minimize arcing and pitting and shall conform to the ratings shown.
      b. Individual door over the front, equipped with a voidable interlock that prevents the door from being opened when the switch is in the ON position unless the interlock is purposely defeated by activation of the voiding mechanism. All switches shall have externally operated handles.
      c. 600 Amps and below equipped for Class J fuses.
      d. 601 Amps and above shall be equipped for Class R or L fuses.
      e. When required by the latest edition of the NEC or the AHJ, 1,200 Amp fused switches regardless of fuse size installed shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).

B. Ground Fault Interrupter (GFI) protection: Where shown or required, ground fault protection shall be achieved with adjustable pickup for ground fault currents, field-adjustable from 200 amperes and instantaneous to 60 cycle time delay. The ground fault protection system shall include necessary current sensors, internal wiring, and relays to coordinate opening the monitored faulted circuits.
   1. Ground fault protection shall be set at minimum setting for both current and time during construction. The manufacturer shall include in the submittal data the minimum setting of the device and the recommended setting for normal building operation.
   2. The ground fault system shall be factory-tested before shipment as specified:
      a. The manufacturer shall provide a factory ground fault protection system test for circuit testing and verification of tripping

characteristics. The manufacturer shall pass predetermined values of current through the sensors and measure the tripping time for each phase and neutral. The measured time-current relationships shall be compared to the trip-characteristic curves. If the ground fault device trips outside the range of values indicated on the curve, the ground fault device shall be replaced or recalibrated.

b. Relays, electrically operated switches, shunt-trip switches, circuit breakers, and similar items shall have proper voltages applied to their circuits and satisfactory operation demonstrated.

c. Upon completion of the factory ground fault protection system test, the current and time on each ground fault device shall be set to minimum values.

2.4 ENCLOSURES

A. Enclosures in indoor locations shall be NEMA 1 unless shown otherwise.

B. Enclosures in exterior locations shall be NEMA 4X stainless steel.

C. Enclosures at kitchen and food preparation locations, exterior kitchen supply and exhaust fans, hose down areas, cooling towers, in greenhouses, and in other corrosive areas shall be NEMA 4X, stainless steel.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General: Install safety and disconnect switches where required or indicated, in accordance with the manufacturer's written instructions, requirements of the NEC, NECA Standard of Installation, and industry practices. Provide fuse identification label when fused switches are required showing type and size inside door of each switch. Include devices in coordination study to indicate overcurrent devices will selectively coordinate.

B. Location: Provide safety switches within 50’ and in sight of motor served. There shall be minimum code required clearance in front of safety switch and a clear path in which to access the switch. (i.e.: not having to walk and/or stand on obstacles such as drain pans on floor to service).

C. Supports: Provide all safety and disconnect switches with galvanized angle or other supports where mounting on wall or other rigid surface is impractical. Switches shall not be supported by conduit alone. Where safety and disconnect switches are mounted on equipment served, the switch shall not inhibit removal of service panels or interfere with access areas, not void the warranty of the equipment served. Provide mounting hardware that will allow removal of safety and disconnect switches with common work tools. Do not utilize drive pin anchors through enclosure.

D. Ground Fault Interrupter (GFI) test and settings: Where adjustable ground fault interrupter settings are provided or required, after completion of construction and before final acceptance testing, the ground fault protection system shall be field-tested and reset to the manufacturer's settings for both current and time by a representative of the manufacturer's engineering service department. After the test, set ground fault to 50-percent of the overcurrent device rating.

E. Safety and Disconnect Switches: Install disconnect switches for motor-driven equipment, appliances, motors, and motor controllers within sight of the controller position unless indicated otherwise.

F. Variable Frequency Drive (VFD) Warning Plaque: Provide VFD warning plaque at safety disconnect switches which are located down-stream of VFDs. Secure plaque to disconnect switch or immediately adjacent to disconnect switch with fasteners. Plaque shall be Yellow-White-Yellow 3-layer plastic laminated engraved with: “WARNING” (1/2 Inch Letters). “TURN OFF VFD BEFORE OPENING THIS SWITCH FOR MAINTENANCE.” (1/4 inch letters).

G. Provide disconnect switch for electric duct heaters.

H. Where disconnect switch is used or indicated as the utility service building disconnect, provide main bonding jumper and neutral to ground bond connected to the building’s grounding system. Do not bond neutral to ground when there is a neutral to ground bond upstream from the same derived neutral system serving the disconnect switch.

I. Disconnect switches related to all smoke control fans shall have auxiliary contacts for fire alarm system monitoring of the position of the disconnect switch, coordinate with Division 28. Coordinate with fire detection and alarm contractor for the fire alarm and detection system to monitor all disconnect switches open/closed position that serve the smoke control system. All fire alarm and control wiring directly related to the monitoring of the supply power disconnect switches and control of the smoke control fans shall be installed in conduit.

3.2 TESTING

A. General: Before energizing, check for continuity of circuits and short circuits.

B. Provide thermal infrared scan of the enclosed switches rated 200 Amps or larger under full load prior to testing / maintenance and modifications and of the modified and new switchboard sections after construction as directed and witnessed by Owner. Make corrections as needed as soon as possible as directed by the Owner. Repeat the scan at the 11-month prior to closeout, and make corrections prior to closeout. Provide digital video documentation with test results for comparison between prior condition and post construction modifications and future tests.

END OF SECTION

SECTION 26 24 30
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 27 73

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 grand 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.

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 SJEO cord, white finish, LED hand lamp. Hubbell #HBLI45163LED with #HBL340PB pivot base.
   2. 20 Amp (2) duplex receptacle cord reels: Industrial grade, 125V, (2) 20A duplex receptacles, GFCI protection, 45-foot 12/3 SJO cord, white finish, yellow outlet box. Hubbell #HBLI45123GF220 with #HBLI340PB pivot base.
   3. 30 Amp receptacle cord reels: Industrial grade, 125/250V, 30A, 45-foot 10/4 SJO cord, white finish, yellow outlet box. Hubbell #HBLI45104 with #HBLI340PB pivot base. 30 Amp NEMA receptacle termination as required by Owner.
   4. 50 Amp receptacle cord reels: Industrial grade, NEMA 4 wet location, 600V, 55A, 50-foot 6/4 SOOW cord, yellow finish, self-retracting, with NEMA 50-Amp maximum receptacle termination as required by Owner. KH-Industries RTMH4L-WW-K6K.
   5. Recessed enclosure for 20 and 30-Amp cord reels recessed above T-grid drop ceilings: Hubbell #HBLIPRBOX recessed cord reel enclosure, white finish, plenum rated.

B. Drop cord receptacles:
   1. 20A, 125V, 25-feet 600 VAC, 3-conductor 12 AWG SOOW cable, twist lock plug, two 125V, 20A duplex WR GFCI outlets, safety yellow rubber outlet box, mesh strain relief cord grips. KH Industries #PP4DD-520-B12F-520.
   2. 20A, 125/250V, 25-feet 600 VAC, 4-conductor 12AWG SOOW cable, twist lock plug, four 125/250V NEMA L1420P outlets, safety yellow rubber outlet box, mesh strain relief cord grips. KH Industries #PP7DD-520-B12F-L1420.
   3. 30-60 Amp, voltage, NEMA plug/receptacle as required by Owner, SOOW cable, number of conductors and length as required, mesh strain relief cord grips.

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 43 00

SURGE PROTECTION DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

A. The Surge Protection Device (SPD) covered under this section includes service entrance type surge protection devices suitable for use as Type 1 or Type 2 Devices per UL1449 5th Edition, applied to the line or load side of the utility feed inside the facility. SPDs shall be connected in parallel with the facility's wiring system. The unit shall be manufactured in the USA by a qualified manufacturer of suppression filter system equipment, which has been engaged in the commercial design and manufacture of such products for a minimum of five years.

B. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified and required to finish and install surge protection devices.

1.2 QUALITY ASSURANCE

A. Reference Standard: Comply with the latest edition of the applicable provisions and recommendations of the following, except as otherwise stated in this document:
   1. UL 1449 Fifth Edition
   2. ANSI/IEEE C62.41, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
   3. ANSI/IEEE C62.45, Guide for Surge Testing for equipment connected to Low-Voltage AC Power Circuits.
   4. IEEE 1100 Emerald Book.
   5. National Fire Protection Association (NFPA 70 (NEC), 75, and 78).
   6. UL 1283 – Electromagnetic Interference Filters

B. When requested for verification, provide copies of the following:
   1. Copies of actual let through voltage data in the form of oscilloscope results for both ANSI/IEEE C62.41 Category C3 (combination wave) and B3 (Ring wave) tested in accordance with ANSI/IEEE C6245.
   2. Copies of test reports from a recognized independent testing laboratory, capable of producing 200kA surge current waveforms, verifying the suppressor components can survive published surge current rating on both a per mode and per phase basis using the ANSI/IEEE C62.41 impulse waveform C3 (8 x 20 microsecond, 20kV/10kA). Test data on an individual module is not acceptable.

1.3 SUBMITTALS

A. Submit shop drawings complete with all technical information for specific unit dimensions, let through voltage data, detailed installation instructions, maintenance manual, and wiring configuration.

B. Provide detailed marked-up copy of this specification with line-by-line compliance or exception statements to all provisions of this specification.

C. Copies of Manufacturer’s catalog data, technical information and specifications on equipment.

D. Copies of documentation stating that the Surge Protection Device is listed from a Nationally Recognized Testing Laboratory (NRTL) (UL, ETL, etc.) and are tested and multi-listed to UL 1449 5th Edition and UL 1283.

F. Copy of warranty statement clearly establishing the terms and conditions to the building/facility owner/operator.

1.4 WARRANTY

A. The manufacturer shall provide a minimum 20-year warranty for high and very high exposure SPDs. Very high exposure unit warranties shall include exposure to temporary extended over-voltage conditions. Provide a minimum 15-year warranty for all medium exposure SPDs, and a minimum 10-year warranty for all other SPDs for parts from date of substantial completion against failure. Contractor shall assist the Owner with manufacturer warranty registration.

PART 2 – PRODUCTS

2.1 APPROVED MANUFACTURER

A. Low exposure, minimum 10-year parts warranty, minimum 50k Amps per mode, 100k Amps per phase, Type 1 and Type 2.
   1. Recessed mount panelboard extension with brushed stainless-steel front:
      a. ACT Communications:471- ###V-050-SS-F-PB flush series.
      b. ABB Current Technology PX3-050-VVV- #X-SF-X-F- # series.
      c. SSI Surge Suppression, Inc. CSMx12-FMPxSS series.
      d. SST Southern Tier Technologies T45-VVVV-50-AWAJ2-C-RKSS(Stainless Steel front).
   2. Branch panelboard surface mounted:
      a. ACT Communications 455 series.
      b. ABB Current Technology CG3 60 series.
      c. SSI Surge Suppression, Inc. CSMx12 series.
      d. SST Southern Tier Technologies T45-VVVV-50AWAJ2-C

B. Medium exposure, minimum 15-year parts warranty, minimum 120k Amps per mode, 240k Amps per phase, Type 2.
   1. ACT Communications 471 series.
   2. ABB Current Technology CGP3 125 series.
   3. SSI Surge Suppression, Inc. CSMx24 series.
   4. SST Southern Tier Technologies T45-VVVV-120A series

C. High exposure, minimum 20-year parts warranty, minimum 200k Amps per mode, 400k Amps per phase, Type 2 SPD.
   1. ACT Communications 471 x200 series.
   2. ABB Current Technology TG3 200 series.
   3. SSI Surge Suppression, Inc. CHLxM series.
   4. SST Southern Tier Technologies T45-VVVV-200A series

D. Very high exposure at service entrance 1,201 Amps and above: Minimum 20-year parts warranty; minimum 200k Amps per mode; 400k Amps per phase, Type 1 and 2 SPD:
   1. ACT Communications 471 x200 SEL series.
   2. ABB Current Technology SEL3 200 series.

   The service entrance protector shall incorporate a combination of TPMOV and Selenium technology allowing for transient surge and temporary over voltage

protection. The unit shall be able to prevent common temporary over voltages and high impedance faults from damaging the MOVs, increasing their longevity and ability to protect the critical load. Limited and Intermediate current TOVs can be caused by a loss of the neutral conductor in a split phase or three phase power system. The available fault current will be determined by the impedance of the loads connected to the phases opposite the SPD and are typically in the range of 30A to 1000A. Minimum 20-year parts warranty, extended over-voltage protection, minimum 200k Amps per mode, 400k Amps per phase, Type 2 SPD. The Selenium elements must limit voltage to the MOV as a percent of nominal as outlined below:

Overvoltage seen by MOVs as % of Nominal				
	available current			
time	30A	100A	500A	1000A
1 cycle	120%	130%	150%	160%
10 cycles	130%	150%	160%	160%
30 cycles	140%	150%	160%	160%

*To verify damage to the MOVs has been mitigated, the percent overvoltage seen at the MOV must be less than 200% for split-phase applications or 173% for three-phase applications (100% is nominal).

2.2 MANUFACTURED UNITS / ELECTRICAL REQUIREMENTS

A. Declared Maximum Continuous Operating Voltage (MCOV) shall be greater than 115 percent of the nominal system operating voltage and in compliance with test and evaluation procedures outlined in the nominal discharge surge current test of UL1449, section 37.7.3. MCOV values claimed based on the component's value or on the 30-minute 115% overvoltage test in UL1449 will not be accepted.

B. Unit shall have not more than 10% deterioration or degradation of the UL1449, Voltage Protection Rating (VPR) due to repeated surges.

C. Protection Modes SVR (6kV, 500A) and UL1449 VPR (6kV, 3kA) for grounded WYE/delta and High Leg Delta circuits with voltages of (480Y/277), (208Y/120), (600Y/347). 3-Phase, 4 wire circuits, (120/240) split phase shall be as follows and comply with test procedures outlined in UL1449: Values Depicted are based on a system Without Disconnect / With Disconnect

System Voltage	Mode	MCOV	C3 Wave	UL 1449 VPR Rating
120/240	L-N	150	650/775	700/800
120/208	L-G	150	650/825	700/900
	N-G	0	500/500	900/1000
	L-L	300	950/1250	900/1200
277/480	L-N	320	1125/1225	900/1200
	L-G	320	1075/1225	1200/1200
	N-G	0	900/900	1200/1500
	L-L	550	1950/2200	1800/1800

D. Electrical Noise Filter- each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric noise shall be as follows using the MIL-STD-220A insertion loss test method.
1. 14 dB from 10 kHz to 1 MHz.

E. Each Unit shall provide the following features:
1. Phase Indicator lights, Form C dry contacts, counter and audible alarm.
2. Field testable while installed.
3. High performance interconnecting cable.
4. The UL 1449 Voltage Protection Rating (VPR) shall be permanently affixed to

the SPD unit.

5. The UL 1449 Nominal Discharge Surge Current Rating shall be 20kA
6. The SCCR rating of the SPD shall be 200kAIC without requiring an upstream protection device for safe operation.
7. The unit shall be listed as a Type 2 SPD per UL1449.
8. Power wiring: SPD shall be equipped with mechanical lugs that can accept up to #2 AWG wire on High Exposure units and up to #6 on Medium and Low Exposure units.

2.3 POWER CABLES FOR CONNECTION

A. Power wiring: Conductors between all high and very-high SPDs and switchgear shall be high performance interconnect system “Low Z Cable” cables with Ultra Low impedance characteristics at 10kHz and above.

B. High Performance Low Impedance cable shall be #6 AWG minimum for Very High, High, and Medium Exposure SPDs and #10 AWG minimum for Low Exposure SPDs.

PART 3 – EXECUTION

3.1 GENERAL INSTALLATION

A. The unit shall be installed as close as practical to the facility's wiring system in accordance with applicable national/local electrical codes and the manufacturer's recommended installation instructions. Connection shall be with high performance, low impedance cables in conduit and shall not be any longer than necessary, avoiding unnecessary bends. Minimum wire size and overcurrent protection device for disconnect shall be provided and as recommended by the manufacturer.

B. Units specified for lighting and appliance panel boards as panelboard extensions (EGPE) shall be mounted directly above or below the first section of the panel board it is protecting. Any other mounting location will not be acceptable and shall be corrected, without exception, at no additional cost to the Owner.

C. Units specified for panelboards, switchboards, or motor control centers shall be mounted directly above or adjacent to the panelboard, switchboard or motor control center using unistrut supports secured to structure as required. Conduit length between power distribution panelboard or switchboard shall be less than two inches. Mounting above equipment is not acceptable.

D. Overcurrent device and conductors for devices shall be the maximum recommended by the manufacturer. Manufacturer’s recommendations shall prevail over the information given in the plans and specifications.

E. Provide recessed mounted panelboard extension type enclosures for devices protecting recessed panelboards. Enclosure front shall match panelboard front material and finish. Provide brushed stainless-steel front at kitchens and food processing areas.

3.2 UNIT SELECTION BASED ON EXPOSURE LEVEL

A. (SPDVH) Provide very-high exposure SPDs with Selenium and TPMOV technology for the following new electrical equipment or where indicated:
   1. Service entrance rated 1,201 Amps and above.

B. (SPDH) Provide high exposure SPDs for the following new electrical equipment or where indicated:
   1. Service entrance rated 801 – 1,200 Amps.
   2. Switchboards located outside.

C. (SPDM): Provide medium exposure SPDs at the following new electrical equipment or where indicated:
   1. Service entrance rated 401 - 800 Amps.
   2. Panelboards above 600 Amps.
   3. Motor control centers.
   4. Non-service entrance switchboards.

D. (SPDL): Provide low exposure SPDs at the following new electrical equipment or where indicated:
   1. Service entrance rated 400 Amps and below.
   2. Panelboards 600 Amps and below.

3.3 TESTING

A. Factory Trained Representative shall provide start-up to include initial verification of proper installation, shortest cable connection, and initiate factory warranty. The technician will be required to do the following as a minimum:
   1. Verify the installation follows applicable national / local electrical codes related to SPDs and the manufacturer's Installation, Operation and Maintenance Instructions and recommendations.
   2. Verify overcurrent device rating.
   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 26 51 13

LIGHTING FIXTURES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Work Included: Lighting fixture work is as shown, scheduled and specified.

B. Applications: The applications of lighting fixtures required for the project include the following:
   1. General lighting
   2. Emergency lighting
   3. Outdoor area lighting

1.2 QUALITY ASSURANCE

A. Provide interior building LED fixtures that comply with the Design Lights Consortium (DLC) standards and are DLC or DLC Premium listed as a Qualifying Product at time of proposal submittal date.

B. UL Standards: Lighting fixtures shall conform to applicable UL standards, and be UL or ETL labeled.

C. Light fixtures shall conform to the requirements of NFPA 101, and 70 (NEC).

1.3 SUBMITTALS

A. Submit product data for light fixtures, and emergency lighting equipment, including generator transfer devices.

B. Specification Compliance Review: Mark up a complete copy of the specification section for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect / Engineer / Owner (Does Not Comply, Explanation:) Do not submit an outline form of compliance, submit a complete copy with the product data.

C. Submittal data shall include luminaire efficiency parameters.

D. Submittal data for exterior luminaries shall include IESNA BUG ratings, backlight, uplight, and glare ratings of each unique luminaire for the orientation and tile specified. Indicate total absolute lumens per luminaire and absolute lumens emitted above horizontal based by each luminaire for the orientation and tile specified.

1.4 WARRANTY

A. Provide 5-year warranty on all light fixtures, including internal or remote LED drivers, all other electrical internal electrical or electronic components except for emergency battery packs or emergency load control device relays. Refer to other specific

component warranty requirements below.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Provide products produced by manufacturers shown or scheduled for each type of lighting fixture. Refer to drawings for additional approved manufacturers.
   1. Light fixtures:
      US LED
      Extra Light
      Acuity
      Hubbell
      Signify
      Cooper Lighting Solutions
      Pinnacle
      HE Williams
      GE Current
      LSI
   2. LED Drivers:
      Philips
      Osram Optotronic
      Eldo LED
   3. Emergency Battery Packs with self-testing drivers/inverters:
      Bodine
      Chloride
      Lithonia
      Dual Lite
      IOTA
   4. Emergency Generator/Inverter Load Control Bypass Relay (ELC); UL924 listed and 0-10Vdc compatible:
      Bodine
   5. Emergency Generator / Inverter Branch Circuit Transfer Switch, UL 1008 listed and 0-10Vdc compatible:
      Bodine GTD20A

2.2 MATERIALS AND COMPONENTS

A. General: Provide lighting fixtures of the size, type, and rating indicated, with all accessories for a complete aesthetic installation.
B. Fixture Types:
   1. General:
      a. LED Lay-in edge lit or back flat panel / troffer fixtures: Opaque, edge or back lighted, 4000 Kelvin color temperature. 0-10 Vdc dimmable, L70: 60,000 minimum hours.
      b. Safety chains and wire guards at fixtures in mechanical and electrical rooms, and high abuse areas. Provide safety chains only for gymnasium fixtures which shall be inherently vandal proof, no wire guards.
      c. Fixtures located outdoors, in interior unconditioned spaces, and in wet locations shall be of aluminum construction.
      d. Fixtures with door frames shall be of aluminum construction, white finish where located in kitchens, food prep areas, toilets, restrooms, locker rooms, dressing rooms, showers, and unconditioned spaces.
      e. DLC, DLC Premium or Energy Star qualified unless specified

otherwise.

f. Outdoor fixtures shall include a discrete / replaceable surge suppression device in addition to the surge suppression incorporated in the LED driver.

g. Operating temperature rating shall be between -40 degrees F and 120 degrees F.

i. Color Rendering Index (CRI): ≥ 80 Indoor; ≥ 65 Outdoor

j. The manufacturer shall have performed JEDEC (Joint Electron Devices Engineering Council) reliability tests on the LEDs as follows: High Temperature Operating Life (HTOL), Room Temperature Operating Life (RTOL), Low Temperature Operating Life (LTOL), Powered Temperature Cycle (PTMCL), Non-Operating Thermal Shock (TMSK), Mechanical Shock Variable Vibration Frequency, and Solder Heat Resistance (SHR).

2. Downlight Fixtures: Provide recessed downlight fixtures with trim rings compatible with the ceiling material where fixture is to be installed.

3. LED Exit Signs: Provide red lettering. The exit lighting fixtures shall meet the requirements of Federal, State, and Local Codes.

a. Gymnasiums, locker rooms, athletic/PE wing and associated corridors, black box theaters, auditorium stages, cafetoriums and kitchens: Vandal resistant, wet location cast aluminum with polycarbonate protective cover exit signs, Lithonia Extreme Series.

4. Emergency Lighting Units: Lead Calcium batteries with self-diagnostics. Provide full light output at 90 minutes of battery operation. LED lamps.

5. Gymnasium light fixtures, glass or acrylic refractors or lenses, round profile, single point swivel pendant or hook mounting, designed to be vandal proof without the need for wire guards, no wire guards.

C. LED drivers:

1. NEMA 410 compliant for in-rush current.
2. Starting Temperature: -40˚ F [-40˚ C].
3. Input Voltage: 120 to 480 (±10%) V.
4. Power Supplies: Class I or II output.
5. Surge Protection: The system must survive 250 repetitive strikes of “C Low” (C Low: 6kV/1.2 x 50 µs, 10kA/8 x 20 µs) waveforms at 1-minute intervals with less than 10% degradation in clamping voltage. “C Low” waveforms are as defined in IEEE/ASNI C62.41.2-2002, Scenario 1 Location Category C.
6. Power Factor (PF): ≥ 0.90.
7. Total Harmonic Distortion (THD): ≤ 20%.
8. Comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.
9. Drivers shall be reduction of hazardous substances (ROHS)-compliant.

D. Voltage: Equipment for use on 120V systems shall be suitable and guaranteed for voltage range of 100V to 130V. Equipment on 277V systems shall be suitable and guaranteed for voltage range of 225V to 290V. Universal voltage equipment shall be suitable and guaranteed for a voltage range of 100V to 290V.

E. Light fixture housing for exterior use: Provide aluminum or stainless housing. Where stainless steel hardware is used, both male and female fasteners shall be stainless steel.

F. Emergency LED battery self-testing drivers and inverters; 5-year warranty. Basis of Design:

1. Bodine BSL-ST Series for OEM installation
2. Bodine BSL310-SI Series for field installation

3. Bodine ELI-S Series for line voltage sine wave inverter field installation

G. Emergency Battery Packs – Exit Signs: Nickel Cadmium battery with self- diagnostics; Minimum 3-year non-prorated replacement warranty.

H. Emergency Generator / Inverter Load Control Device (ELC):
1. 16 Amp minimum ballast / driver load
2. Compatible with 0-10 Volt dimmer switches
3. UL 924
4. Minimum 3-year warranty
5. Integral or remove test switch.

I. Emergency Generator / Inverter branch circuit transfer switch:
1. UL 1008
2. 20 Amp ballast/driver load
3. 0-10Vdc dimming compatible

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install lighting fixtures of the types indicated, where shown, and at indicated heights in accordance with the fixture manufacturer's written instructions and industry practices to ensure that the fixtures meet the specifications. Fixtures shall fit the type of ceiling system scheduled.

B. Standards: Comply with NEMA standards, applicable requirements of NEC pertaining to installation of interior lighting fixtures, and with NECA Standard of Installation.

C. Attachment: Fasten fixtures to the indicated structural support members of the building. Provide four separate wire supports for recessed ceiling mounted lighting fixtures, one at each corner of fixture. Check to ensure that solid pendant fixtures are plumb. Provide T-bar locking clips on all four sides for lay-in fixtures.

D. Coordination: Field coordinate and locate lighting fixtures in open ceiling areas including mechanical and electrical rooms so that light is not obstructed by piping, ductwork, etc. Locate light fixtures in front of electrical and mechanical equipment to provide adequate illumination for testing and maintenance. Relocate installed light fixtures as directed by Owner / Architect at no additional cost.

E. Final adjustment of all aimable exterior light fixtures shall be in coordination with, and to the satisfaction of, the Owner’s designated representative. Pre-aim all fixtures prior to scheduled final aiming and adjustment with Architect / Owner. Verify that all rotatable optics are in their proper orientation prior to final aiming.

F. Provide vandal resistant exit signs without wire guards in all physical education and athletic sports areas, including egress corridors adjacent to these areas, black box theaters, auditorium stages, vocational shops, cafetoriums and kitchens.

G. Provide exit sign directional arrows as required. Provide a minimum of two and a maximum of 10% spare exit signs to be installed as directed by Architect.

H. Install in accordance with manufacturers instructions.

I. Install suspended luminaires using pendants supported from swivel hangers. Provide pendant length required to suspend luminary at indicated height.

J. Locate recessed ceiling luminaires as indicated on the Architectural reflected ceiling plan.

K. Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prohibit movement.

L. Exposed Grid Ceilings: Support surface mounted luminaires on grid ceiling directly from building structure. Provide auxiliary members spanning ceiling Ts to support surface mounted luminaires. Fasten surface mounted luminaires to ceiling T using bolts, screws, rivets, or suitable clips.

M. Install recessed luminaires to permit removal from below.

N. Install recessed luminaires using accessories and fire stopping materials to meet regulatory requirements for fire rating.

O. Install wall-mounted luminaires at height as directed by Architect.

P. Install accessories furnished with each luminary.

Q. Connect luminaires to branch circuit outlets using flexible conduit as specified.

R. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaires.

S. Bond products and metal accessories to branch circuit equipment grounding conductor.

T. Provide emergency transfer devices for light fixtures powered by generator or inverter emergency lighting circuits which are used for normal lighting and to be switched with the switched normal lighting circuit in the same room, corridor or area.

U. Provide un-switched, constant-hot circuit to all battery powered emergency lighting equipment and emergency load control devices (ELC). Where normal light fixture circuit is switched or contactor controlled, non-switched battery charging or ELC circuit shall originate from same branch circuit breaker as switched lighting circuit.

V. Provide emergency powered light fixture in front of all electrical switchgear, including but not limited to panelboards, switchboards, motor control centers, low voltage control panels, transfer switches, motor controllers and disconnect switches.

W. Provide emergency battery operated light fixtures at all transfer switch locations and at all central battery emergency lighting inverters.

X. Provide automatic controls for exterior light fixtures. Exterior building mounted light fixtures shall be circuited through lighting contactors. Lighting contactors shall be controlled by the Building Management System. Provide separate lighting contactors for:
   1. Parking Lot Lighting
   2. Building Mounted Lighting
   3. Exterior Signage

Y. Lighting contactors shall not be installed above ceiling and shall be readily accessible, located in same room as panelboard serving load.

Z. Wall mounted light fixtures shall be attached to the studs in the walls. Attachment to gypsum board only is not acceptable. Where wall mounted fixtures attach to junction box only, firmly secure junction box to adjoining studs in wall.

AA. Lighting Fixture Supports:
1. Shall provide support for all of the fixtures. Supports may be anchored to channels of the ceiling construction to the structural slab or to structural members within a partition, or above a suspended ceiling.
2. Shall maintain the fixture positions after cleaning and relamping.
3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.

BB. Hardware for surface mounting fixtures to suspended ceilings:
1. In addition to being secured to any required outlet box, fixtures shall be bolted to a grid ceiling system at four points spaced near the corners of each fixture. The bolts shall be not less than 1/4 inch secured to channel members attached to and spanning the tops of the ceiling structural grid members. Non-turning studs may be attached to the ceiling structural grid members or spanning channels by special clips designed for the purpose, provided they lock into place and require simple tools for removal.
2. In addition to being secured to any required outlet box, fixtures shall be bolted to ceiling structural members at four points spaced near the corners of each fixture. Pre-positioned 1/4-inch studs or threaded plaster inserts secured to ceiling structural members shall be used to bolt the fixtures to the ceiling. In lieu of the above, 1/4-inch toggle bolts may be used on new or existing ceiling provided the plaster and lath can safely support the fixtures without sagging or cracking.

CC. Lighting Fixture Supports for aluminum canopies:
1. Light fixtures mounted under aluminum canopies shall be UL wet location from above listed without a protective ceiling or cover. Light fixture shall not have conduit penetrations or mounting hole penetrations field made in the top of the fixture. Conduit penetration shall be at the end of the fixture only.

3.2 TESTING

A. General: Upon installation of lighting fixtures, and after building circuits are energized, apply electrical energy to demonstrate proper operations of lighting fixtures, emergency lighting, and controls. When possible, correct malfunctioning units at the site, then retest to demonstrate proper operation; otherwise, remove and replace with new units, and proceed with retesting.

B. Pre-Inspection Tasks: Immediately before final inspection, clean fixtures inside and out, including plastics and glassware, adjust trim to fit adjacent surfaces, replace broken or damaged parts, and lamp and test fixtures for electrical and mechanical operations. Any fixtures, or parts of fixtures that show signs of rust or corrosion at the time of completion, shall be removed, and replaced with protected metal parts.

C. Final aiming and Adjustment: Aim and adjust aimable and adjustable lighting fixtures for their intended purpose. Re-aim and re-adjust as required to the satisfaction of the Architect / Owner, including nighttime adjustment of exterior lighting in the presence of

the Architect / Owner.

END OF SECTION

SECTION 26 55 61

HIGH SCHOOL AUIDITORIUM AND BLACKBOX THEATRICAL LIGHTING SYSTEM

PART 1 – GENERAL

1.1 INTENT

A. The intent of this specification is to define parameters for furnishing and installing a complete and working renovated dimming system in the high school auditorium and a new dimming and control system in the black box. Performance deviations will not be accepted. One company shall be responsible for installing or coordinating the installation of all aspects of the stage equipment. Work under this section shall include the furnishing of all labor, materials, tools, transportation services, supervision, commissioning, etc., necessary to complete installation of new stage equipment.

B. The contractor shall remove existing theatrical lighting components and retain existing infrastructure needed for the installation of the new equipment. Refer to drawings for additional information.

C. All work must be in compliance with the National Electric Code and applicable local codes.

D The contractor is responsible for providing a complete and working system. All items needed for a complete working system meeting the design intent of the plans and specifications are to be included, even if not specifically listed.

E. Refer to plans for locations and quantities of equipment for auditorium and black box spaces.

1.2 APPROVED EQUIPMENT

A. Dimming, Controls, and Fixtures:
   1. Basis of design: Electronic Theatre Controls.
   2. Strand Lighting

B. Follow spot:
   1. CantoUSA

1.3 SUBSTITUTIONS

A. Specific items of equipment are listed by trade names. It is neither the purpose nor intent of these documents to eliminate competitive proposals.

B. Accompanying each request shall be a letter specifically detailing each substitution including catalog data, specifications, operative samples, technical information, drawings, performance and test data, and complete descriptive and functional information to assist in a fair evaluation. Substitution requests shall be submitted for each component of the lighting and rigging system and shall be evaluated separately. Requests shall also include a detailed line-by-line specification compliance letter. Any deviations from the specifications or drawings shall be listed and explained. Failure to submit any substitution for prior approval or not providing sufficient data for evaluation shall require the exact item specified to be furnished. Approval will be granted by Addenda Only.

C. Owner's approval of a substitution for proposal purposes will not relieve the contractor from the responsibility of meeting all specification criteria. If an approval of a substitution is granted, the Contractor shall be fully responsible for any and all changes such substitution shall require.

1.4 QUALITY ASSURANCE

A. To ensure a complete uniform installation and single point of responsibility for system design and warranty, one manufacturer shall provide all dimming, rigging, control system and fixture components. The mixing of equipment brands will not be accepted.

C. Manufacturer shall provide local on-site service for the system for a period of two years from date of acceptance by the Owner. This person or firm must be regularly engaged in the service of dimmers. A salesperson or sales agent without dedicated service personnel does not meet this requirement.

D. This specification details specific operational and functional needs of the Owner. Deviations from the performance requirements will not be accepted from any supplier. Contractor assumes the responsibility of removing any non-complying material discovered during the warranty period and replacing it with specification compliant equipment.

E. Due to the specialty nature of theatrical lighting equipment, a Theatrical Systems Contractor shall provide the theatrical dimming, rigging, and control equipment to the Project Electrical Contractor, as well as providing support and coordination services to ensure a complete working system.

E. The Theatrical Systems Contractor shall be an authorized dealer of the specified manufacturers and have been actively engaged in the sales, installation, commissioning, repair, and maintenance of theatrical lighting equipment for no less than ten (10) years. Evidence of experience for projects of similar size and scope shall be submitted if requested. This evidence shall include a reference list for a minimum of five projects including: job name, contact name and phone number, scope, and contract value.

F. The Theatrical Systems Contractor shall be an authorized service center for repair and support of the specified dimming products with a dedicated manufacture certified service technician available for local support.

G. The Theatrical Systems Contractor shall directly employ personnel with the manufacture’s Rigging Certification for the installation of all overhead rigging components.

1.5 SERVICES

A. Services of qualified project manager, representing the manufacturer, and employed full time in the sales and service of control systems, shall be provided during the installation period to answer questions and review the installation.

B. Services of a qualified technician, representing the manufacturer, and employed full time in the service of control systems, shall be provided for one visit upon 21 days’ notice. This technician shall terminate all low voltage control wiring, inspect the installation, energize the system, and program and commission the theatrical lighting

control system. The technician shall also instruct the Owner in proper operation and maintenance of the system.

C. During the warranty period, the manufacturer shall provide a toll-free 24-hour-per-day number for telephone technical support and service requests.

1.6. DRAWINGS

A. Dimming System Manufacturer shall provide .pdf electronic files for submittals, including system risers, rack schedules, and manufacturer cut sheets for all equipment.

B. Dimming System Manufacturer shall provide .pdf electronic files for Operation & Maintenance Manuals, to include Operation Manuals for all supplied equipment.

1.7 WARRANTY

A. The dimming manufacturer shall provide a two (2) year parts and labor warranty on the entire theatrical lighting system from date of acceptance. This warranty shall be totally inclusive of service calls, travel, etc. at no additional cost to the Owner.

B. The dimming manufacturer shall provide a five (5) year parts warranty on all LED theatrical light fixtures. The LED light array shall have a ten (10) year parts warranty

1.8 SCOPE OF WORK

A. This section includes the following lighting control system equipment
   1. Dimmers
   2. Controls
   3. Distribution
   4. Lighting instruments, lamps, and associated portable equipment

B. Work under this section shall include the furnishing of all labor, materials, tools, transportation services, supervision, etc., necessary to complete the installation of new stage equipment as detailed in these specifications and accompanying documents.

C. The Auditorium system shall be completely renovated per plans: Upgrade the existing dimmer rack with a new 3-year parts and labor warranty, provision of new relay modules in quantities as needed, replacement of all house light fixtures, and replacement of all theatrical fixtures, theatrical work lights, and controls.

D. The new Black Box shall be provided with new controls and fixtures as shown on plans and as required for a fully operational system.

E. The Theatrical Systems Lighting Contractor shall be responsible for the following:
   1. Provide all dimming, control, and distribution equipment as detailed and required in these specifications and associated drawings and as needed for a fully functional system.
   2. Provide shop drawings indicating system layout, control wiring, physical mounting locations, and mounting techniques of all equipment.
   3. Install motorized and dead rigging, dead hung pipes, pipe mounted circuit boxes, and raceways as required.
   4. The Theatrical System Lighting Contractor shall employ only fully trained stage riggers and mechanics for the erection of the stage equipment. The stage riggers shall be completely familiar with the type of equipment to be installed. A competent job superintendent shall be on the job at all times when work is in progress. The job superintendent must be certified in theatre rigging

by the manufacturer. A copy of the certification must be furnished to the General Contractor prior to the start of the installation.

5. Provide Factory Authorized Service Technician to perform system commissioning, low voltage terminations, installation of control plates, system programming. Technician shall provide a minimum of eight hours of training, four hours on two separate days, to Owner's Representative. Coordinate training schedule with Owner.
6. Provide all lighting fixtures and accessories as indicated or required. All fixtures shall be unboxed, lamped, aligned, hung, and focused into a stage wash.
7. Provide control setup and training for the Owner, including fixture patch and zone control of the complete lighting plot. Provide a minimum of 4 standard stage presets for typical stage uses as a starting point for the Owner: Label them: "Rehearsal", "Speaker", "Performance" and "AV". Program up to four (4) additional presets as requested by the Owner.

F. The Project Electrical Contractor shall be responsible for the following, with performance requirements as specified in other Division 26 specifications:

1. Installation of all dimming and control racks and equipment, including mounting of racks on walls, power feeds as required, and installation of custom back boxes.
2. Provision and installation of all standard back boxes
3. Provision and installation of all 120-Volt distribution circuits, and all 120/208-Volt feeder circuits for the theatrical lighting system
4. Terminating of all 120v and 120/208v power and distribution circuits, both in the dimmer cabinet, and at the circuit distribution.
5. Provision and installation of all conduits, junction boxes, electrical wire ways, and cable trays as required for the lighting systems, including low voltage control systems.
6. Pulling all high and low voltage cables into conduit.
7. Clean all racks, panels, and boxes of dirt, dust, and debris, re-assemble all equipment, and replace all panels, covers, and screws prior to time of system factory energization and training.
8. Coordination with the Theatrical Contractor on all aspects of the rigging and electrical installation and low voltage cable runs. Follow all manufacturer submittal plans and installation recommendations. Actively facilitate coordination with the General Contractor and Structural Engineer for all structural attachment needs. Schedule adequate time at the end of the job for Theatrical Systems Contractor to commission the system before turnover to the owner and before substantial completion.
9. At time of System Commissioning, Project Electrical Contractor is responsible for providing access to all low voltage termination points for termination and testing to the Service Technician. This includes lifts, ladders, temporary lighting, and personnel required to reach any position the Service Technician needs access to. Electrical Contractor shall also provide personnel as needed to the Service Technician for troubleshooting and any needed wiring changes, terminations, or testing. These personnel shall be made available whenever the service technician is on the job site.
10. Electrical Contractor is responsible for advance scheduling with the Theatrical Systems Contractor. Theatrical Systems Contractor shall be given at least 21 days' notice of request for system startup. The Electrical Contractor is responsible for having all equipment installed and wiring pulled & terminated prior to the arrival of the Theatrical Systems Contractor Service Technician for commissioning. If the jobsite is not ready when the Theatrical Systems Contractor has been scheduled to arrive, and additional trip(s) are necessary,

the Electrical Contractor shall pay necessary additional trip charges at no additional cost to the Owner.

G. Provide all components necessary to make the system a complete and working lighting system.

H. Verify site conditions and system layout during the project approval process, coordinating with other trades as required.

1.9 SUBMITTALS

A. Submit product data for theatrical dimming equipment, controls, and fixtures.

B. Submit project superintendent's factory certifications for theatre rigging.

C. Specification Compliance Review: Mark up a complete copy of the specification section for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect / Engineer / Owner (Does Not Comply, Explanation:) Do not submit an outline form of compliance, submit a complete copy with the product data.

PART 2 – PRODUCTS

2.2 ENTERTAINMENT CONTROLS (EOS)

A. Product: Ion XE 20 as manufactured by ETC Inc.
   1. Model Ion Xe 20 2K: Ion Xe 20 console, 2,048 outputs (base)
   2. Power consumption: Approximately 2 A at 120 V or 230/240 V.
   3. Ambient Room Temperature: 32 to 95 degrees F (0 to 35 degrees C).
   4. Ambient Humidity: Up to 90 percent non-condensing.
   5. Regulatory Compliance: CE compliant, cETLus listed, UKCA marked, FCC compliant, RoHS compliant, and WEEE.
   6. Hardware and Interfaces:
      a. Supports two external display port monitors (1920 x 1080 min, 3840 x 2160 max). Optional single-touch or multi-touch screen control and DDC/CI support.
      b. Twenty 45 mm standard faders, 100 10-fader pages configurable as channels, submasters, palettes/presets, timing, and effect rate/speed playback control.
      c. Two internal monochromatic LCD displays for fader content.
      d. Main Playback with two 100 mm standard faders.
      e. Four encoders for non-intensity parameter control.
      f. Dedicated high-resolution intensity level wheel.
      g. Backlit Eos keypad.
      h. Included USB keyboard.
      i. Solid-state hard drive.
      j. IEC Power Input: 100 to 240 Vac at 50/60 Hz, fused mains power switch, locking regionalized power cable included.
      k. Two individually configurable Gigabit Ethernet ports, RJ45 connectors.
      l. One 802.11ac Wi-Fi Ethernet adapter. To be enabled with future software.
      m. Bluetooth 5.1 for connecting input accessories. To be enabled with future

software.
n. sACN and Art-Net network output protocols.
o. Four DMX-512 / RDM 5-pin XLR ports.
p. Contact closure triggers via D-Sub connector.
q. USB 3.1 ports, for flash drives, pointing devices, keyboards.
1) USB-A Ports: 5. USB-C Ports: 2
r. One Littlite XLR port.
s. One Kensington lock port.
t. Multiple MIDI and/or SMPTE timecode inputs, MIDI In and Out, Analog/Serial Inputs, OSC transmit/receive, UDP transmit/receive through network interface or Response Gateways.

2.3 ENTERTAINMENT CONTROLS (MULTIVERSE)

A. Product Multiverse Node as supplied by ETC Inc.
1. Model:5902 (900 MHz / 2.4 GHz)
2. Use Environment: Indoor.
3. Regulatory Compliance: FCC and IC. IP Rating: IP50.
4. Warranty: One year.
5. Physical:
a. Length: 4.05 inch (102.8mm). Width: 2.36 inch (60 mm). Height: 1.44 inch (36.47 mm) 1.44 inch.
b. Antenna: 3dBi.
c. User Interface: 4 Button/Backlit LCD display.
d. Construction: Die Cast Aluminum, Black.
e. Power Connector: Locking DC Jack, 5.5 x 2.1 mm, center positive, 12.1 mm mating depth.
6. Electrical:
a. Power: 5 to 30 Vdc, 1W
b. Broadcast Power: 3.2 mW, 10 mW, 32 mW, and 100 mW.
c. Broadcast Modes: Adaptive, Full, Low, Mid, High, Max.
d. DMX Burst Modes: Auto dynamic.
e. Ethernet Protocols: N/A.
f. SHoW IDs: Multiverse: 307; Neo: 70.
g. RF Sensitivity: -95 dBm.
h. RDM Features: RDM Proxy, and RDM Responder.

2.4 ENTERTAINMENT CONTROLS (RESPONSE)

A. Product: Response Mk2 Four-Port Gateway by ETC Inc.
1. Model: RSN-DMX4-T Response Mk2 4-Port Gateway 4 Terminal.
2. Standards Compliance: cETLus Listed, CE compliant, EAC certified, RoHS compliant, and WEEE.
3. Functional:
a. Supports Net3/ACN per ANSI E1.31 and E1.17, RDM (ANSI E1.20), and Supports USITT DMX512-A per ANSI E1.11.
b. Compliance: USITT DMX512 and ANSI E1.11 DMX512-A.
c. Flexible Output Patch: Allows a 512-address universe to begin at any output address.
d. Advanced Input Patch.
e. Support for per-addressor per-universe-level priority.
f. Delay Time: From input to output not greater than one packet time.
g. Selectable DMX refresh rate: Maximum of 40 Hz.
h. Supports 256 total RDM devices.

4. Mechanical:
    a. Intuitive four-button interface.
    b. Onboard display for identification, status, and configuration.
    c. Fabricated from 16-gauge cold-rolled steel.
    d. Finish: Black, Fine-textured, powder-coat.
    e. C-clamp and U-bolt hardware available.
    f. Half 19-inch equipment rack width allows eight DMX ports in 1U height.
    g. Network, power, and data activity LED indicators.
        1) Blue power indicator, green network activity indicator.
        2) Bi-color DMX activity indicator.
    h. Repositionable RJ45 connector for connection to lighting network.
    i. Reset button for hard reset or forced reboot.
5. Environmental:
    a. Ambient Operating Temperature: 32 to 104 degrees F.
    b. Operating Humidity: 95 percent non-condensing.
    c. Storage temperature: Minus 40 to 158 degrees F.
6. Electrical:
    a. Compliant with IEEE 802.3i for 10BASE-T, 802.3u for 100BASE-TX and 802.3af for Power over Ethernet.
    b. Power Input: 12 to 24 VDC for use with non-PoE systems.
    c. Maximum seven-watt current draw.
7. Configuration:
    a. Local configuration options.
    b. Remote configuration by Concert.
        1) Supports 512 DMX addresses per port.
        2) Supports 63,999 Streaming ACN universes.
    c. DMX data input or output configurable by user.
    d. Multiple sources may be combined to the network with each source or address allowing an independent priority.
    e. Individual port start address and offset.
    f. User-configurable labeling.

B. Product: Response Mk2 One-Port Gateway by ETC Inc.
1. Standards Compliance: cETLus Listed, CE compliant, EAC certified, RoHS compliant, and WEEE.
2. Color: As determined by the Architect from the Manufacturer's offering.
3. Functional:
    a. Supports Net3/ACN per ANSI E1.31 and E1.17, RDM per ANSI E1.20, and USITT DMX512-A per ANSI E1.11.
    b. Compliance: USITT DMX512 and ANSI E1.11 DMX512-A.
    c. Flexible Output Patch allows a 512-address universe to begin at any output address.
    d. Advanced Input Patch.
    e. Support for per-addressor per-universe-level priority.
    f. Maximum delay time from input to output not greater than one packet time.
    g. Selectable DMX refresh rate: At least 40 Hz.
    h. Supports 256 total RDM devices.
4. Mechanical:
    a. Intuitive four-button interface,
    b. Onboard display for identification, status, and configuration.
    c. Enclosed electronics assembly and faceplate.
    d. No visible means of attachment.
    e. Flush-mount in industry standard backbox, RACO 690 or equivalent. Surface-mounted backboxes available.
    f. Construction: Injection-molded, ABS plastic.

g. Green LED: For network activity indication.
h. RJ45 connector for connection to lighting network.
i. Reset button: For hard reset or forced reboot.

5. Environmental:
   a. Ambient Operating Temperature: 32 to 104 degrees F.
   b. Operating Humidity: 95 percent non-condensing.
   c. Storage temperature: Minus 40 to 158 degrees F.
6. Electrical:
   a. Compliant with IEEE 802.3i for 10BASE-T, 802.3u for 100BASE-TX and 802.3af for Power over Ethernet.
   b. Power Input: 12-24 Vdc for use with non-PoE systems.
   c. Maximum power draw: 4 W.
7. Configuration:
   a. Local configuration options.
   b. Remote configuration by Concert.
      1) Supports 512 DMX addresses per port.
      2) Supports 63,999 Streaming ACN universes.
   c. DMX data input or output configurable by user.
   d. Multiple sources may be combined to the network with each source or address allowing independent priority.
   e. Individual port start address and offset.
   f. User-configurable labeling.

C. Product: Response Mk2 Two-Port Gateway by ETC Inc.
1. Standards Compliance: cETLus Listed, CE compliant, EAC certified, RoHS compliant, and WEEE.
2. Two-Port Gateways: Portable.
   a. Model: RSN-DMX2-O-P. Portable 2-port Gateway. 2 Output.
3. Color: As determined by the Architect from the Manufacturer's offering.
4. Functional:
   a. Supports Net3/ACN per ANSI E1.31 and E1.17, RDM per ANSI E1.20, USITT DMX512-A per ANSI E1.11.
   b. Compliance: USITT DMX512 and ANSI E1.11 DMX512-A.
   c. Flexible Output Patch allows a 512-address universe to begin at any output address.
   d. Advanced Input Patch.
   e. Support for per-addressor per-universe-level priority.
   f. Maximum delay time from input to output not greater than one packet time.
   g. Selectable DMX refresh rate with a maximum of at least 40 Hz.
   h. Supports up to 256 total RDM devices.
5. Mechanical:
   a. Intuitive four-button interface.
   b. Onboard display for identification, status, and configuration.
   c. Enclosed electronics assembly and faceplate.
   d. No visible means of attachment.
   e. Flush-mount in industry standard backbox, RACO 690 or equivalent. Surface-mounted backboxes available.
   f. Construction: Injection-molded, ABS plastic.
   g. Network and power activity LED indicators.
      1) Blue power indicator, green network activity indicator.
      2) RJ45 connector for connection to lighting network.
   h. Reset button: For hard reset or forced reboot.
6. Environmental:
   a. Ambient Operating Temperature: 32 to 104 degrees F.
   b. Operating Humidity: 95 percent non-condensing.

c. Storage temperature: Minus 40 to 158 degrees F.

7. Electrical:
   a. Compliant with IEEE 802.3i for 10BASE-T, 802.3u for 100BASE-TX and 802.3af for Power over Ethernet.
   b. Power Input: 12 to 24 VDC for use with non-PoE systems.
   c. Current Draw: Maximum 4 W.
8. Configuration:
   a. Local configuration options.
   b. Remote configuration by Concert.
      1) Supports 512 DMX addresses per port.
      2) Supports 63,999 Streaming ACN universes.
   c. DMX data input or output configurable by user.
   d. Multiple sources may be combined to the network with each source or address allowing an independent priority.
   e. Individual port start address and offset.
   f. User-configurable labeling.

D. Product: Response Opto-Splitter by ETC Inc. Provides quality and reliable DMX data distribution using industry-standard DMX and RDM.
1. Model: RSN-OPTO-16T. 16 Port Rackmount Terminal.
2. Standards Compliance: cETLus Listed, CE compliant, EAC certified, RoHS compliant, and WEEE.
3. Functional:
   a. No configuration required.
   b. Supports DMX512, DMX512 (1990), DMX512-A, ANSI E1.20 Remote Device Management (RDM).
   c. Supports 256 total RDM devices.
4. Mechanical:
   a. Rack-mount form factor:
      1) Aluminum fabrication.
      2) Fine-textured, powder-coat finish. Color: Black.
      3) Equipment Rack Width: Full 19 inch.
      4) Mounting: Front or rear facing.
   b. DIN rail form factor:
      1) Enclosure: Molded plastic.
      2) Mounting: Complies with DIN43880 (35/7.5 rail).
      3) The unit is 9 DIN units wide.
      4) DIN installation enclosure available.
   c. Power and Data Activity LED Indicators: Power: Blue. DMX activity: Green.
5. Environmental:
   a. Ambient Operating Temperature: 32 to 104 degrees F (0 to 40 degrees C).
   b. Operating Humidity: 5 to 95 percent non-condensing.
   c. Storage temperature: -40 to 158 degrees F (-40 to 639 degrees C).
6. Electrical:
   a. Supports DMX input and DMX through.
   b. Provides optically isolated DMX/RDM outputs.
   c. Rack-Mount Form Factor:
      1) Power Unit: 100 to 240 VAC 50/60 Hz.
      2) User configurable front or rear IEC C13 power connector position.
      3) Power Draw: 35 W max.
      4) XLR, RJ45 and Terminal connector options.
   d. DIN Rail Form Factor:
      1) Power Input: 12 to 48 Vdc power input.
      2) Power Draw: 8 W max.
      3) Wiring connections use pluggable rising clamp terminals.

e. DIN Box form factors include a suitable power supply.

2.5 POWER CONTROL ENCLOSURES

A. Product: Sensor3 Installation Enclosures (SR3) by ETC Inc. Power control system with high-density, professional features and exceptional reliability for lighting applications requiring power control.
   1. SR3-48 Enclosure: 48 modules, 96 circuits maximum.
   2. Mechanical:
      a. Construction: 16 ga steel.
      b. Finish: Fine-textured, scratch-resistant epoxy paint.
      c. Top and Bottom Conduit: Access through removable panels (SR3-48) or knockouts (SR3-6, SR3-12, and SR3-24).
      d. Keyed module slots prevent insertion of incompatible module types.
      e. Front access to all wiring and terminations.
      f. Full height locking door.
      g. Electrostatic air filter easily removed from door for periodic cleaning.
      h. High-efficiency cooling system with reporting.
      i. High-visibility LED status beacon.
   3. Electrical:
      a. SR3 Enclosures Accept the Following Feeds:
         1) Power: Three-phase 120 / 208 Vac.
      b. Line Feed Frequencies: 47 to 63 Hz.
      c. Line Feed Voltage Range: 91 to 139 Vac. Max main transformer tap recommended is 135 V to allow for line fluctuation.
      d. Short Circuit Current Rating: 100,000 Amps RMS symmetrical.
   4. Thermals:
      a. 32 to 104 degrees F. Electrical Room HVAC Systems: Must maintain the specified ambient temperature at all times.
      b. Relative Humidity: 10 to 90 percent non-condensing.
   5. Control: CEM3 Power Control Processor.
      a. Construction:
         1) Body: Formed steel.
         2) Face Panel: Diecast.
         3) Finish: textured epoxy paint.
      b. Slide-In Module: Toolless installation and removal. Spring-loaded release.
      c. Airflow Sensor: Ensures adequate airflow.
      d. Two configurable DMX512 inputs (rear, 2500 V opto-isolated).
      e. Two Ethernet ports:
         1) Front: for direct service connection.
         2) Rear: for operation of lighting control network.
      f. Graphical LCD: Eight lines by 20 character for system configuration, live control, and status display.
      g. Number Pad: For quick access to dimmers.
      h. Shortcut Buttons: For Setup, about, and live control.
      i. Five Status LED Indicators: Power, Network activity, DMX-A DMX-B, and Panic.
      j. User-Programmable Presets: 64.
      k. UL 924 Listed Panic circuit with flexible configuration.
      l. Configuration Backups: Saved on USB or network.
      m. Dimmer Outputs: Regulate to maintain constant power plus or minus 1 Volt.
      n. Individual output scale voltage settings for load wiring compensation.
      o. Selectable Firing Modes: Normal, Forward Phase, Reverse Phase, Dimmer Doubled, Sinewave, and Fluorescent.

p. Control Modes: Dimmed, Switched, Latch/lock, Always On, and Off.
q. Selectable Dimmer Output Curves: Linear, Modified Linear, Square, Modified Square, Sensor 2.0, and five custom curves.
r. 16-bit fade resolution. Greater than 30,000 Step Resolution per 1/2 cycle.
s. Selectable data loss behavior.
t. Feedback:
1) Sensor racks with CEM3 modules include basic system diagnostic reporting.
2) Standard Rack Feedback Includes: DMX input status, rack power status, and rack temperature.
3) Advanced Features (AF): Provides dimmer-specific status and load feedback. Requires AF dimmer rack and AF dimmer modules.
u. Mobile Application: ThruPower System Reporter (TPSR).
1) Mobile application shall select the circuit to configure either by scanning a QR code label applied to circuit distribution or by manual entry of circuit information.
2) Mobile application shall allow users to set the Control Mode of the selected circuit in order to shift a ThruPower module between Dimmable and Switched mode according to the requirement of a connected load.
3) Mobile application shall allow users to activate the circuit test function for the selected module.
4) Power controls which do not support mobile circuit configuration from the plugin location of a supported load shall not be acceptable.

6. Power Control Modules:
a. Rated for continuous duty at 100 percent of rated load.
b. Circuits: 1.2 kW, 1.8 kW, 2.4 kW, and 6 kW.
c. Physical: Dual density (two circuits per module), modular plug-in assemblies. Keyed to prevent improper insertion.
d. Cast aluminum chassis, finished with textured epoxy paint.
e. Circuit Breakers: Fully magnetic to eliminate nuisance tripping.
1) Inrush Current Rating: 20x.
2) Must Trip Rating: 125 percent, 10 to 100 seconds.
3) Rated for 100 percent switching duty applications.
7. Power Device: Sealed, patented assembly. Field-replaceable with screwdriver.
a. Per-circuit LED indicators.
b. Mechanical held air gap relay.
c. Integral bonded heatsink.
d. Integral temperature sensor.
8. Filtering: High quality toroidal filters.
9. Sensor3 Module Series:
a. Relay Series: Air-gap relays for switched power control.
10. Standards Compliance: Listed: cULus.
11. Quantities and configurations of Sensor3 enclosures, modules, and accessories to be supplied as shown on project drawings.

B. Echo Relay Panel Feedthrough (ERP-FT) by ETC Inc. 48-output branch circuit switching and power control enclosure. Integrated DMX and Ethernet connectivity. Optional 0-10 V, DALI, and contact input control cards. UL 924 listed for emergency lighting control.
1. Mechanical: Enclosure covers with locking doors, and internal subpanels.
a. Construction: Steel, 16 ga.
b. Finish: Fine-textured, scratch-resistant powder coat paint. Color: Black.
c. Removable Conduit Panels: On top, bottom, and sides.
d. Full Front Access: No side clearance required.
e. Removable Covers: For access to Class 1 and 2 wiring.

f. Locking Doors: Controlled access to manual override switch of each relay and Class 2 wiring.
g. Low-Voltage Wiring: Physically separated from AC by a mechanical barrier.
h. Removable Subpanels: Containing electronics and relays.

2. Thermal:
   a. Operating Temperature: 32 to 104 degrees F (0 to 40 degrees C).
   b. Humidity: 10 to 90 percent, non-condensing.
3. Electrical:
   a. Discrete feed per circuit supports mixed voltage in a single panel.
   b. Single panel for 48 relays, populated in any combination of single- or double-pole.
   c. Separate Wiring Chambers: For Class 1 and Class 2 terminations.
   d. Voltage barriers: Toolless installation between relays. Separation of normal and emergency circuits.
4. Relay Kits:
   a. ERP-FT-1PRK: single-pole, 120-347 V, 20 A relay kit.
5. Relay Ratings:
   a. General Purpose: 20 Amp, 347 V.
   b. Ballast (HID): 20 Amp, 347 V.
   c. Tungsten: 20 Amp.
   d. Motor Loads: 0.5 HP at 120 V. 1.5 HP at 240/277 V.
   e. SCCR: 18,000 Amp at 277 V, 1 Phase. 5,000 Amp at 277 V, 2 Phase.
   f. Inrush: 2000 Amp; 1 P only.
   g. Isolation: 2,500 V RMS.
   h. State: Latching.
   i. Relays are mechanically held.
   j. Life: 60,000 operations at full load.
   k. Terminal: Accepts 14 to 10 AWG copper wire.
6. Control:
   a. User interface:
      1) Graphical display with LED backlight.
      2) Button Interface With: 0 to 9 number buttons.
      3) Navigation Buttons: Up, down, back and enter.
      4) "Light bulb" test button for local preset activation, sequence and set level overrides.
      5) USB interface: For upload of setup and software updates.
   b. User interface power input: 120 to 277 V, plus or minus 15 percent, 50/60 Hz. Less than 16 Amp.
      1) Multi-Tap Transformer Terminals: Accept 12 AWG wire.
   c. Control Wiring Terminations: Accessible via flip down door.
      1) Control Terminals: Accept 12 AWG wire.
      2) Control Wiring Exiting Panel: Class 2.
      3) Control Terminations: Utilize removable connectors.
   d. Relay Modes: Normal (priority/HTP), latch-lock or last-action.
   e. Configurable DMX on/off threshold.
   f. Control configuration:
      1) Sixteen spaces with 64 presets per space configurable via local UI.
      2) One 16 step sequence per space.
      3) UL924 Listed emergency control bypass.
   g. Configurable Data-Loss Behavior: Play preset; Hold last look; Wait and fade.
7. Standards Compliance: Listed to the following standards:
   a. UL508 Listed (File: E92154) and UL924 Listed (File: E242514).
   b. Complies with ANSI E1.11 DMX512-A and ANSI E1.31 streaming ACN.
8. Quantities and configurations of Echo Relay Panel Feedthrough enclosures, relay

kits, and accessories to be supplied as shown on project drawings.

2.6 CIRCUIT AND DATA DISTRIBUTION

A. Product: Circuit and data distribution as supplied by ETC Inc.
   1. Pigtail and outlet boxes.
   2. Gridiron junction boxes.
   3. Electronic control plug-in boxes (ECPB).
   4. Mechanical:
      a. Construction: Boxes constructed from 18 ga and 14 ga steel. NEMA and ECPB faceplates constructed of aluminum.
      b. Finish: Fine-textured black powder coat.
      c. Include mounting brackets and hardware.
   5. Electrical:
      a. Wire Entry: Conduit knockouts to feed-through terminals individually labeled with corresponding circuit numbers.
      b. Wire Exit: Connectorized receptacles, conduit knockouts, or cable glands.
      c. Low voltage barriers or junction boxes as required.
   6. Finish: Fine-textured black powder coat paint.
   7. Circuit Labels: 2 in. (50 mm); vinyl; white lettering on black; front only.
   8. Standards Compliance: cULus Listed to UL 1573 and CSA C22.2 No. 166.
   9. Power and data distribution equipment to be supplied as shown on project drawings.

2.7 ARCHITECTURAL CONTROLS – ECHO

A. Interfaces:
   1. Product: Unison Echo EchoAccess Interface.
      a. Model: EACC EchoAccess Interface.
      b. Communication from EchoAccess mobile app to devices on EchoConnect system bus via Bluetooth Smart.
      c. Mobile app available for Android and iOS.
      d. Preset, zone and color control for Echo products.
      e. Advanced feature configuration of Echo products.
   2. Standards Compliance: UL and cUL Listed. CE Compliant.
      a. California Title 24 compliant.
   3. Functional: Unison Echo EchoAccess Interface.
      a. Remote control of preset activation/deactivation, record, raise, lower, zone on/off control and room combine.
      b. Control of Zone Intensity, Color, Tint, and Color Temperature.
      c. Configuration of all Echo Control and Output Products.
      d. Configurable security levels for both connection and configuration.
   4. Mechanical:
      a. Flush-mount in industry standard backbox, RACO 690 or equivalent Constructed of injection-molded, ABS plastic.
      b. Gangable for custom applications.
      c. Enclosed electronics assembly and faceplate included.
      d. Power and Bluetooth activity indicators.
         1) Blue power status indicator.
         2) Amber Bluetooth activity indicator.
   5. Electrical:
      a. MicroSD card slot for firmware maintenance.
      b. Connects to two-wire EchoConnect control networks through low-voltage Class 2 wiring.

1) Topology-Free Wiring: Belden 8471 and No. 14 ESD drain wire.
2) Two No. 16 AWG wires for 24 VDC auxiliary power when required.

6. Operational Room Temperature: 32 to 122 degrees F (0 to 50 degrees C).
7. Relative Humidity Non-Condensing: 5 to 95 percent.

B. Stations:
1. Standards Compliance: cULus Listed. CE Certified.
2. Functional:
   a. Button and Fader Functions: preset activation/ deactivation, record, raise, lower, zone on/off control and room combine.
   b. Blue button illumination for active status.
   c. Amber or no button illumination for inactive status.
   d. Fader halo-illumination displays actual output level.
   e. Zone or preset control from any station with real-time user toggle.
3. Mechanical:
   a. Enclosed electronics assembly and faceplate included.
   b. No visible means of attachment.
   c. Flush-mount in industry-standard backbox, RACO 690 or equivalent.
   d. Surface-mount backboxes available from manufacturer.
   e. Constructed of injection-molded, ABS plastic.
   f. Cantilevered switch arrays with removable button caps.
   g. User configurable legends on each button or use standard legends that come with each station. Field configurable without the use of tools.
   h. Integral LED response indicator for each button with indication of active(blue) and inactive (amber or off) state.
4. Electrical:
   a. Connect via EchoConnect control network. Low-voltage Class 2 wiring.
   b. Topology-free wiring over Belden 8471 and one No. 14 ESD drain wire.
      1) Control Wiring: 1640 ft (500 m).
   c. Belden 1583A or equivalent Ethernet control wire when used with Cat5 termination accessories.
      1) Control Wiring: 1000 ft (300 m) using CAT5.
   d. Wiring: Bus, loop, homerun, or any combination of these.
   e. Station Terminations: Removable connectors.
5. Operating Temperature Range: 32-122 degrees F (0-50 degrees C).
6. Relevant Humidity Non-Condensing: 5-95 percent maximum.

C. Power Modules:
1. Product: Unison EchoConnect Station Power Supply by ETC Inc.
   a. Model E-SPS-DIN: DIN Rail Mount Station Power Supply with 24 V Aux.
2. Convert Input Power into Class II Low-Voltage Power with data line. Energize control stations, zone controllers, time clocks, and devices for multi-scene lighting control.
3. Electrical:
   a. Utilize line-voltage power supplied by contractor, terminated inside dimming enclosure, or power supply.
   b. EchoConnect Communications with Remote Devices: Control stations, zone controllers, time clock stations and other devices.
   c. EchoConnect Network: Low-voltage Class II twisted pair wiring, type Belden 8471 (unshielded) or Belden 8719 (shielded). And one No 14 AWG drain wire for system not using grounded metal conduit.
      1) Topology Free Network: Bus, loop, home run, star, or any combination.
      2) Control Bus Wiring: Permit total wire runs of 1640 ft (500 m)
      3) Wiring Between Stations: Not to exceed 1313 ft (400 m).

4) CAT5 Wiring: For systems not requiring topology free infrastructure or EchoConnect bus lengths not more than 1000 ft (305 m).

4. Capacity: Power for up to 16 control stations, zone controllers, time clock stations and other devices, and/or provide 24 V Auxiliary Power to devices that require it.

D. Touchscreen Control Stations to be Unison Echo EchoTouch Controller Mk2 by ETC, Inc. Controls 512 DMX addresses on up to 80 control zones.

1. Standards Compliance: cULus Listed and CE Compliant. FCC Compliant.
2. Operation: Graphic buttons, faders, and images on at least 7 user programmable default and fully graphical control pages.
3. Touchscreen: Integrated with ETC Unison Echo Controls.
   a. Seven-inch, backlit liquid crystal display. Resolution: 800 by 400 pixels minimum, with capacitive multi-touch interface.
   b. Bezels: Cast aluminum. Finish: Fine texture powder coat.
      1) Four colors: Cream, Gray, Black, or Signal White.
      2) No visible means of attachment.
   c. Supports Surface, Flush and Rack Mounting.
      1) Flush-mount: To industry standard 3 gang back box.
      2) Surface Back Box Dimensions (WxHxD): 7.35 x 4.88 x 3.5 inches 187 x 124 x 3.5 89 mm) available from Manufacturer.
      3) Rack Mounting: Fit in standard 19-inch (483 mm) racks, no taller than 3 EIA rack units.
4. Electrical:
   a. RJ45 Ethernet Port: Connection to lighting system and Power over Ethernet.
   b. Control Wiring: EchoConnect Connection terminals.
      1) Low-voltage, Class II unshielded twisted pair, type Belden 8471 and one No. 14 ESD drain wire, when not installed in grounded metal conduit.
      2) Topology free. Point-to-point, bus, loop, home run or any combination.
   c. Power Input, Non-PoE: Two, No. 16 AWG stranded wires for 24 VDC.
   d. Typical Current Draw: 400 mA.
   e. Firmware Maintenance: USB type A connector.
   f. Network:
      1) Network Cabling: Category 5 or better. Conform to TIA-568A/B. Installed by qualified network installers.
   g. Functional System:
      1) Presets: 64. Contained in non-volatile electronic memory.
      2) Internal sequences: 4. Record user-selected zone levels.
      3) Touchscreen: Equipped with on-board help system.
      4) Software upgrades: Via USB drive only.
      5) USB Port: Show data to be saved for archival or transfer to other consoles or a personal computer.
   h. Patching: Facilities for dimmers and multi-parameter devices via built in library of fixture definitions.
      1) Fixture Library: Updated via software-based updates. Create custom fixture definitions using an offline application.
      2) Touchscreen: Support patching, address setting, and mode changes using Remote Device Management (RDM) on local DMX/RDM port.
   i. Playback Control: Customizable zone display. Rearrange graphical representations for control channels to mimic fixture positions in installation.
      1) Seven user customizable interactive pages.
      2) Color and white pickers.
      3) Touch-based parameter controls with reference-based palettes.
      4) Virtual level wheel.

j. Layout and Configuration: View and modify layout of user pages.
1) Add, remove, or edit the following items: Preset buttons. Off buttons. Sequence buttons. Zone and space modifier buttons. Space combiner buttons. Zone fader.
2) Three Options for Inactivity: Dim screen to level. Turn the screen off. Display user chosen inactivity image.
3) Multiple Configurations: May be stored within an LCD Station.

5. Time Clock: Touchscreen built-in astronomical and real time event engine allowing presets and sequences activation.
a. Support 80 Events: Astronomical, real-time, and manual control events in 16 control spaces.
b. Timed Events: Programmable via Touchscreen.
1) Assigned to day types.
a) Day Types: everyday, weekday, weekend, and day of week.
2) Activation: Based on sunrise, sunset, time of day, opened and closed events and configurable state-based engine.
3) Compensate for regions using daylight saving time.
4) Assignment to events via time clock user interface.
5) Resumes automatically after power loss.
c. Support timed event hold. Timed Event Hold: Meet CA Title 24 requirements.

6. External Control: Control of lighting system through built-in UDP integration.
a. Supports full control of lighting system using UDP strings.
1) Security settings to limit incoming control strings to subscribers-only.
b. Supports up to two subscribers for receiving status messages.
c. Control and status integrations from 3rd party systems include:
1) Zones.
2) Channels.
3) Presets.
4) Spaces.
5) Sequences.
6) Lockout.

2.8 ARCHITECTURAL CONTROLS – PARADIGM

A. Touchscreens:
1. Product: Unison Paradigm Portable Touchscreen by ETC, Inc.
a. Model P-TS7-PE: 7 in Portable Touchscreen (NetConnect/Ethernet).
2. Product: Unison Paradigm 7 inches Touchscreen by ETC, Inc.
a. Model P-TS7-E-X: Paradigm 7-inch Touchscreen.
3. Standards Compliance: UL and cUL LISTED. CE Compliant.
4. Functional:
a. Built-in setup interface, separate from user configured pages.
b. Configuration Upload from the Following Sources:
1) LightDesigner software.
2) USB Flash Drive, via built in USB port.
3) SD media.
c. Ability to store multiple configurations and to select which configuration is active from an on-screen menu.
d. Allows at least 30 separate control pages.
e. Control Functions:
1) Individual zone control.
2) Preset record and selection.
3) Room Combine Controls.

4) Preset, color, sequence, macro, and custom function activation.
5) Change, initiate, or override timed events.
6) Multi-level electronic lockout.
f. Custom controls configured from LightDesigner software.
g. Custom graphics configured from ControlDesigner software.
h. Supports Windows 7 and newer HID compliant Touchscreen Displays.
i. Software controlled lock-out and control visibility using up to 5 unique passcodes.

5. Mechanical:
a. LED-backlit, color LCD display with touchscreen interface.
b. Aluminum enclosure in black anodized finish.
c. Adjustable brightness and contrast for low light conditions.
d. 7-inch WVGA display (800x480) with 24-bit color.
e. LCD touchscreen covered by lid when in closed position.
f. 10 ft removable cable (NetConnect model only).
g. 1U 19-inch Rackmount kit.

6. Mechanical:
a. Color LCD display with projected capacitive touchscreen interface with LED backlight.
b. 178 degree horizontal and vertical viewing angle.
c. Low-profile aluminum bezel finished in a fine-texture powder coat paint.
d. No visible means of attachment.
e. Manufacturer provided back boxes for surface and flush mount applications.
f. Adjustable brightness and contrast for low light conditions.
g. 7-inch WVGA, display (800x480).

7. Electrical:
a. Connection to Unison Paradigm control system using Unison Heritage portable plug-in stations (UH1RS) or Ethernet Stations (UH-NET).
b. Linkconnect Network uses Topology free and polarity independent Class 2 control network over Belden 8471 plus two No. 16 for 24 Vdc Aux Power and one No. 14 ESD drain wire.
1) Wiring may be bus, loop, home-run, or any combination of these.
c. NetConnect wiring uses standard Ethernet Infrastructure over twisted pair ethernet.
1) Star topology using standard PoE Ethernet Switches.
2) PoE Class 2 Device (6 W).

8. Electrical:
a. Connection to Paradigm Control System utilizes standard Ethernet (CAT5/5e).
1) Powered by Power over Ethernet, PoE Class 2 (6-watts).
2) Requires ground wire.

9. Operating Temperature Range: 32 to 104 degrees F (0 to 40 degrees C).
10. Relevant Humidity Non-Condensing: 0 to 90 percent.

B. Unison Control Series:
1. Product: Paradigm Architectural Control Processor by ETC, Inc.
a. Model P-ACP: Unison Paradigm Architectural Control Processor.
b. Standards Compliance: cULus Listed. CE Compliant.
c. Functional:
1) Capacity:
a) Channels of Control: 1,024.
b) Stations: 128.
2) System:
a) Net3 system interoperability including sACN.

b) Network Time Protocol for real-time clock synchronization supporting real and astronomical events.
c) Two physical DMX ports, each configurable as an input or output.
d) Configuration of DRd dimming operations.
e) 12 control processors per system.
1) The addition of processors to a system proportionately increases the overall capacities.

3) Serial Input/Output:
a) Eight-bit word length, parity selection and one or two stop bits.
b) Fully customizable input and output messages.
c) Bi-directional.

4) Configuration Data:
a) Remote upload from a connected PC running LightDesigner or another connected Paradigm ACP.
b) Stored in removable solid-state memory for easy transfer to another Paradigm ACP.

5) Local User Interface:
a) Control functionality for control channels, zones, fixtures, groups, presets, macros, walls, and sequences.
b) Ability to schedule timed events (add/edit/delete).
c) Transfer of configuration using removable media.
d) Transfer of configuration to and from touchscreen stations using removable media.

6) User Access Controls: Two user accounts: Administrator and User. Local to each processor.

7) Web User Interface:
a) Internal web server accessible via Ethernet port.
b) Activate and deactivate presets.
c) Schedule timed events (add/edit/delete).
d) Displays status information and log files.
e) Configuration of processor settings.
f) Supports configurable user login security options.

8) Diagnostics: Standard and Critical Event logging.

9) Stations:
a) Connected to a Paradigm processor via topology-free LinkConnect, or star-topology NetConnect.
b) Discovery and binding accomplished from the local user interface or LightDesigner.

10) Operation:
a) Configurable DMX output refresh rate.
b) Support for 16-bit DMX attributes.
c) User configurable arbitration for multiple internal and external source data.

d. Mechanical:
1) For use in Unison DRd Rack Enclosure Series and Unison ERn Control Enclosure Series.
2) Microprocessor-based, solid-state technology provides multi-scene lighting and building controls.
3) Fully contained plug-in module with no discrete wire connections.
4) Tool-free installation.
5) Front-panel user interface with backlit LCD and alphanumeric button panel.
6) RJ-45 Ethernet, Secure Digital (SD) and Universal Serial Bus (USB) media on front panel.

e. Electrical:
    1) No discrete wiring connections required for use in a dimming or control enclosure.
    2) Echelon LinkPower communications with remote devices, including button stations, button/fader stations, touchscreen stations, sensors, and third party LonMARK compliant products.
    3) Hot swappable.
    4) System configuration and programming stored in flash memory.
    5) Support of ESTA BSR E1.17 Advanced Control Networks (ACN) and ESTA BSR E1.31 (sACN) Protocols.
    6) EIA-RS232 serial protocol for bi-directional command and communication with third-party equipment.
    7) Two discrete ESTA DMX512A ports, configurable as input or output ports.
    8) User Datagram Protocol (UDP) messaging input and output for control of Paradigm or external systems.
    9) Four dry-contact closure inputs.
    10) Four contact-closure outputs rated 1 A at 30 Vdc.
f. Operating Temperature Range: 32-104 degrees F (0-40 degrees C).
g. Relevant Humidity Non-Condensing: 10 to 90 percent.

2. Product: Unison Paradigm Station Power Module Mk2 by ETC, Inc. For use with Unison DRd and ERn enclosures with Paradigm control. Addition of Station Power Module offers support for button, fader, and touchscreen stations.
    a. Model P-SPM-E: Unison Paradigm Station Power Module Mk2.
    b. Standards Compliance: cULus Listed. CE Compliant.
    c. Functional:
        1) Provides Echelon LonTalk with LinkPower for up to 63 stations.
        2) Provides 24 V auxiliary power for interface and touchscreen stations.
        3) Provides 1,640 ft (500 m) of station bus from the ERn or DRd enclosure.
    d. Mechanical:
        1) Designed for use in Unison Dimming (DRd) and Control (ERn) Series Enclosures.
        2) 18-gauge formed steel construction.
        3) Fine-textured, scratch-resistant, epoxy paint.
        4) Wall-mount and 19 in rack-mount variants available.
        5) Convection cooled.
        6) Fully contained plug in module with no discrete wire connections.
        7) Tool-free installation.
        8) Front-panel status indicators.
    e. Electrical:
        1) No discrete wiring connections required for use in a DRd dimming or ERn control enclosure.
        2) Echelon LinkPower communications with remote devices, including button stations, button/fader stations, touchscreen stations, sensors, and third-party LonMARK-compliant products.
        3) 24 V Auxiliary power for interface and touchscreen stations.
    f. Operating Temperature Range: 32 to 104 degrees F (0 to 50 degrees C).
    g. Relevant Humidity Non-Condensing: 10 to 90 percent.
3. Product: Unison ERn External Control Enclosure by ETC, Inc.
    a. Model ERn2-RM-xx Single Processor Control Enclosure-Rack Mount.
    b. Standards Compliance: cULus Listed, CE Compliant.
    c. General:
        1) External Processing Enclosure designed for one or two control processors plus options and accessories.

2) Full 2-year Warranty.

d. Mechanical:
1) 18-gauge formed steel construction.
2) Fine-textured, scratch-resistant epoxy paint.
3) Wall-mount and 19-inch rack-mount variants.
4) Rack-mount enclosure sizes: ERn2: 5U and ERn4: 8U.
5) Rack mount offers connectorized rear panel for all wiring connections.
6) Convection-cooled.
7) Hinged, Locking door with limited access to control processor. Integral electrostatic air filter.
8) Tool-free module removal and installation.
9) 19-inch equipment-rack mount offers connectorized rear panel for all wiring connections.
10) Wall-mount offers front access wiring terminations.
11) Top, bottom, and side knockouts for conduit entry.

e. Electrical:
1) External control enclosure rated for 100 V, 120 V, 230 V or 240 V UL single phase configurations, 3.5 A maximum draw at 120 V.
a) AC (single phase).
b) 24 Vdc (2-16 AWG).
c) LinkConnect.
d) Two configurable DMX512A ports.
e) RS232 Bi-directional serial.
f) Cat5/5e UTP Ethernet.
g) Contact I/O, 4in/4out (14 to 26 AWG).
1) Contact output rated 1 A at 30 Vdc.
2) Contractor-supplied input and control wiring.
3) Factory-provided connectors for wiring terminations.

f. Operating Temperature Range: 32 to 104 degrees F (0 to 50 degrees C).

g. Relevant Humidity Non-Condensing: 10 to 90 percent.

C. Unison Heritage Control Series:
1. Product: Unison Heritage Button Station by ETC, Inc.
a. Standards Compliance: cULus Listed. CE Compliant.
b. Mounting: Flush, Surface.
c. Functional:
1) Button and key switch functions: preset selection, record mode activation, station lockout, raise, lower, macro activation, zone on/off control, timed-event override, and wall open/close or toggle.
2) Custom button functionality programmable via LightDesigner configuration software.
3) Programmable electronic lockout levels.
4) Allows for programming of individual lockout levels.

d. Mechanical:
1) Gangable for custom applications.
2) Enclosed electronics assembly and faceplate included.
3) Cantilevered switch arrays with removable caps.
4) No visible means of attachment.
5) Flush-mount in industry standard back box, RACO 690 or equivalent.
6) Surface-mount backboxes available from manufacturer.
7) Constructed of injection-molded, ABS plastic.
8) Indelibly marked legends in contrasting colors.
9) Integral RGB LED response indicator for each button.
10) Integrated IR receiver.
11) Unison Heritage Locking Cover.

e. Electrical:
1) Connect via Echelon LinkPower control network utilizing low-voltage Class II wiring.
2) Topology-free and polarity-independent wiring over Belden 8471 and one No. 14 ESD drain wire.
a) Wiring may be bus, loop, homerun, or any combination of these.
3) All station terminations are connectorized.
f. Operating temperature Range: 32 to 104 degrees F (0 to 40 degrees C).
g. Relative Humidity, Non-Condensing: 30 to 90 percent.

2. Product: Unison Heritage Fader Stations.
a. Standards Compliance: cULus Listed. CE Compliant.
b. Functional:
1) Operate default or custom system functions, including preset selection, manual mode activation, record mode activation, station lockout, raise, lower, sequence control, zone on/off, room combine, macro activation and timed-event override.
2) Fader functions include master, zone, fade rate, or preset.
3) Custom button and fader functionality programmable via LightDesigner configuration software.
4) Programmable electronic lockout levels.
5) Buttons allow programming of individual lockout levels.
c. Mechanical:
1) Enclosed electronics assembly.
2) Faceplate with no visible means of attachment.
3) 45 mm slide potentiometer faders and cantilevered switch arrays with removable caps.
4) Flush-mount in industry-standard backboxes.
5) Surface mount back boxes available from manufacturer.
6) Constructed of injection-molded, ABS plastic.
7) Indelibly marked legends in a contrasting color
8) Integral RGB LED response indicator for each button and fader.
9) Integrated IR receiver.
10) Unison Heritage Locking Cover.
d. Electrical:
1) Connect via Echelon LinkPower control network utilizing low-voltage Class II wiring.
2) Topology-free and polarity-independent wiring over Belden 8471 or equivalent, and one No. 14 ESD drain wire.
3) Wiring may be bus, loop, homerun, or any combination of these.
4) All station terminations are connectorized.
e. Operating Temperature Range: 32 to 104 degrees F (0 to 40 degrees C).
f. Relative Humidity, Non-Condensing: 30 to 90 percent.

2.9 ARCHITECTURAL CONTROLS - EMERGENCY CONTROL PRODUCTS

A. Product: DMX Emergency Bypass Controller by ETC, Inc. Where required to trigger special-purpose lighting presets and bypass normal lighting controls during emergency or panic situations.
1. Model DEBC-1: DMX Emergency Bypass Controller, 1-output.
2. Capable of overriding a single universe of DMX512 control signals from "Normal" to "Bypass" when a trigger signal is detected via a contact closure trigger input.
a. Output to a single DMX output or up to six optically isolated DMX outputs.
b. Poll bypasses trigger input after a power loss and react upon start up.

c. Recalled immediately on restart if trigger is also applied at restart.

3. Capable of recording a single DMX preset (snapshot) of 512 channels for recall during "Bypass" mode.
4. Internally accessible, labeled DIP switches for configuration of:
   a. DMX Record Mode: 512 channels. Selected channels, snapshot.
   b. Contact Input Type: Normally open (default). Normally closed.
   c. Wait Time for Restore incoming DMX; Bypass Trigger Removed: 0 Seconds (default). 10 seconds wait. 30 second wait. 10-minute wait.
5. Single Bypass Input Using Two Input Modes:
   a. Bypass Triggering: Via a maintained contact input configurable for normally open (N.O.) or normally closed (N.C.) operation.
   b. Contact Input: 12 Vdc wet input for interface with fire alarm or secondary trigging systems.
6. Mechanical:
   a. Surface Mounted Enclosure. Removable Front Cover: 16-gauge, formed steel.
   b. Single Bi-Color LED Indicator: Visible from exterior of enclosure.
      1) Normal State: Green light when Power and DMX are present.
      2) Off indicates Power or DMX are not present.
      3) Bypass State: Red light. Includes bypass input contact trigger or 'test' active.
   c. Test Button: Front enclosure accessible without removing panels.
      1) Triggers bypass state if it is held down. Releases bypass state upon button release.
         a) Button: Momentary only. Recessed to prevent accidental triggering.
   d. Single, internally accessible button for DMX Record (snapshot) with an indicator LED for record action.
      1) Record Button: Momentary only and held for 3 seconds before activation to prevent accidental recording.
      2) LED indicator: Flashes rapidly when record function is active and illuminate steady when record function is complete.
7. Electrical: Internally pre-wired by Manufacturer.
   a. Contractor to provide input feed and control wiring to terminals.
      1) Input Power: 100 to 277 V, 50/60 Hz, 150 mA maximum current.
   b. Labeled terminations for two 24 to 10 AWG solid or stranded power wires.
   c. One Grounding Lug for 24 to 14 AWG solid or stranded ground wire.
   d. Labeled, socketed termination connections for DMX Input and Output wiring.
      1) Terminations support Belden 9729, 1583A Category 5 cable, or equivalent.
   e. Labeled, socketed termination for bypass contact input.
      1) Termination to support two, 30 to 12 AWG low-voltage wires.
      2) Bypass Input: To maintain normally open (N.O.) or normally closed (N.C.) dry contact input.
      3) Wet Contact Input: 12 Vdc for fire alarm system interface.
      4) Socketed DMX transceiver chips.
         a) Spare chip in labeled, inactive socket.
   f. Internally switch from normal DMX input (pass through) to bypass DMX output using electromechanical relays when triggered.
      1) Non-Volatile Memory: For storage of single recorded sequence of 512 channels.
         a) Recorded sequence to persist through power outages.
         b) Default Sequence: 512 channels at "full" if no sequence is recorded.
      2) DMX Baud Rate: "Slow," 20 packets per second for increased

compatibility during bypass DMX output.

g. Two versions capable of output to a single DMX line or up to six optically isolated DMX lines.

h. Standards Compliance: UL and cUL Section 924 Listed for interaction with similarly listed products.

8. Room Operating Temperature: 32 to 104 degrees F (0 to 40 degrees C).
   a. Humidity non-condensing: 10 to 95 percent.

B. Product: Emergency Bypass Detection Kit by ETC, Inc. To detect loss of normal power and trigger special-purpose lighting presets.
   1. Model EBDK: Emergency Bypass Detection Kit.
   2. Standards Compliance: UL and cUL Section 924 Listed.
   3. Surface Mounted Enclosure. Removable Front Cover: 16-gauge, formed steel.
      a. Finish: Fine textured, scratch-resistant, powder coat paint.
   4. Breaker: 3 pole, 10 amp for local over-current protection and simulation of normal power loss.
   5. Lockable Door: Limits access to over-current protection breaker.
   6. Components to be properly treated and finished.
   7. Discrete high and low voltage wiring compartments with voltage barrier.
   8. Electrical:
      a. Input Power: 100 to 277 V. Field configurable for single-phase, bi-phase, and three-phase operation without additional components.
      b. Phase Loss Detection Circuitry: 0.5 second delay to prevent nuisance tripping.
      c. Integrated Circuit Breaker: Over-current protection and normal power loss simulation.
      d. Isolated Outputs: For connection to multiple dimming products simultaneously.
         1) Three Isolated Contacts: Each support connection of four dimming products.
      e. Pre-wired by Manufacturer. Contractor to provide input feed and control wiring.
      f. Control Wire Connections: Terminated via factory provided connectors.
         1) Support 12 to 22-gauge wiring.
         2) Emergency Lighting Input: Support load shedding.
      g. Bypass Detection Kit: Proves a normally closed input for interface with fire alarm systems. UL and cUL Section 924 Listed for interaction with similarly listed dimming and switching panels.
   9. Operating Temperature Range: 32 to 104 degrees F (0 to 40 degrees C).
      a. Humidity non-condensing: 10 to 90 percent.

C. Product: UL924 Emergency Lighting Device to be the Automatic Load Control Relay by ETC, Inc. Allows standard lighting control devices to control emergency lighting in conjunction with normal lighting in any area within a building.
   1. Model ALCR-PP-Mk2: Automatic Load Control Relay Power Pack.
   2. Standards Compliance: UL and cUL listed to UL924 standard and labeled for connection to normal and emergency lighting power sources.
   3. Control of emergency lighting fixtures in tandem with normal lighting in an area while ensuring emergency lighting will turn on immediately to full brightness upon loss of normal power supplying the control device. Independent for each controlled area and will not require a generalized power failure for proper operation.
   4. Two Form Factors Available:
      a. ALCR-PP-Mk2: Power pack model. Constructed of 94-V-0 plastic enclosing high voltage components and mounts to 1/2 inch (13 mm) electrical junction box knock out using a thread nipple and retaining nut.

1) Flying lead connections for power and 0 to 10 V.
2) Terminal connections for DMX.

b. ALCR-DIN: Din rail mount with terminal connections

5. Breaks data circuit upon loss of normal power supporting fixtures that switch to full brightness upon loss of an incoming data signal.
   a. ALCR-PP-Mk2: Supports DMX and two circuits of 0 to 10 V pass-through for intensity and color temperature control.
6. Capable of switching 20-amp emergency ballast loads at 120-277 Vac, 60 Hz, or 10-amp tungsten loads at 120 Vac, 60 Hz.
7. Universal Rated Voltage Input: For normal power sense and normal switched power at 120-277 Vac, 60 Hz.
8. Integral Momentary Test Switch: Press and hold switch forces emergency mode and turns on emergency lighting. Releasing switch returns unit to normal operation unless optional "return to normal" delay has been programmed.
9. Dedicated leads and 24 Vdc source for connection to remote triggering device such as test switch, fire alarm system, or other external system capable of providing a normally closed dry contact closure.
   a. Remote Trigger: Install no further than 1000 ft wire distance from ALCR. Breaking loop or contact between the terminals forces and holds emergency lighting on until loop is closed.
   b. Integral LED indicator indicates unit's current remote activation status.
10. Status and Remote LEDs indicate device state.
    a. Status LED: Indicates whether emergency output is required and active. Lit Green: Normal power is present. Lit Red: Emergency output is active due to remote activation or due to loss of normal power.
    b. Remote LED: Lit Amber: Indicates normal lighting control is commanding emergency light to be active. Unlit Dark: Normal control is open (off).
11. Device's Normal Power Input Lead: Connected to line side of control device such that any upstream fault causing a loss of power, including tripping of branch circuit breaker, will force unit into emergency mode and turn on emergency lighting.
12. Programmable "Return to Normal “Delay: Keeps lights on for a period of 15 minutes after normal state returns such that any egress in progress can complete before a normally dark area is allowed to return to its dark state. Programmable delay options include instant, 10 seconds, 30 seconds, 10 minutes, and 15 minutes.
13. Zero crossing circuitry to protect relay contacts from damaging effects of inrush current generated by switching electronic ballast loads.
14. Unit Housing: UL2043 plenum rated and equipped with flying leads.

2.10 ENTERTAINMENT LUMINAIRES (4WRD SERIES)

A. Basis of Design: Source 4WRD PAR/PARNel as manufactured by ETC Inc. Transforms Source 4WRD II LED or S4WRD Color II LED engine into a soft light.
   1. Fixture bodies for use with Source 4WRD II or SrWRD Color II LED retrofit.
   2. Works just like a Source Four PAR or PARNel, using the same accessories.
   3. Brighter than the 750 W HPL versions.
   4. Uses same Source 4WRD II LED or Source 4WRD Color II retrofit as the Source 4WRD ellipsoidal.
   5. Standards Compliance:
      a. cULus.
      b. CETL when used with ETC Source 4WRD LED Retrofit.
   6. Source:
      a. S4WRD II or S4WRD Color II LED sold separately.

7. Optical:
    a. Beam Angle Range: PAR: 10 to 36 degrees. PARNel: 13 to 30 degrees.
    b. Gate Size: N/A.
    c. Aperture Size: 7 inches.
    d. Pattern Projection: No.
    e. Pattern Size: N/A.
    f. PAR: AR coated flat lens. PAR lenses sold separately.
    g. PARNel: ships with PARNel lenses.
8. Physical: IP Rating: IP-20.
    a. Materials: Die-cast aluminum. Colors: Black, white, silver, or custom.
    b. Mounting Options: Yoke.
    c. Included Accessories: Color frame.
    d. Includes S4WRD mounting post. Required S4WRD II or S4WRD Color II LED available separately.

2.11 ENTERTAINMENT LUMINAIRES (COLORSOURCE)

A. Basis of Design: ColorSource CYC as manufactured by ETC Inc. A dedicated cyclorama fixture for creating beautiful, smooth washes of light on a cyclorama or wall. Five-color mix of red, green, blue, lime, and indigo for expanded range and color control.
1. Standards Compliance:
    a. Listed: cETLus, UL 1573, and CSA C22.2 No. 166.
    b. Compliance: CE and EAC.
2. Source:
    a. LED Details: 42 Lumileds LUXEON C LEDs.
    b. Max Lumens: 4117.
    c. Lumens per Watt: 31.
    d. L70 rating: greater than 50,000 hours.
3. Color:
    a. Colors Used: Red, Green, Blue, Indigo, and Lime.
    b. Color Temperature Range: Range.
    c. Calibrated Array: Yes.
    d. Red Shift: No.
4. Optical:
    a. Beam Angle Range: DMX-512 via 5-pin XLR connector
    b. Gate Size: N/A.
    c. Aperture Size: N/A.
    d. Pattern Projection: No.
    e. Pattern Size: N/A.
    f. Camera Flicker Control/Hz Range: Default: 1,200 Hz. RDM: 25,000 Hz.
    g. The ColorSource CYC has a built-in accessory for spill control.
5. Control:
    a. Input Method: DMX-512 via 5-pin XLR connector. Protocols: DMX.
    b. Modes (Footprint): 5 channels: IRGBS (5). Direct: IRGBILS (7). 1 channel: (1). RGB: RGB (3).
    c. RDM Configuration: Yes.
    d. User Interface Type: 7-segment address display, local level control via UI.
    e. Local Control: Yes.
    f. Onboard Presets: Yes, 12. Onboard Sequences: Yes, 5. Onboard Effects: No.
    g. FixtureLink support: Yes.
6. Electrical:
    a. Voltage: 100 to 230 Vac, 50 to 60 Hz.
    b. Input Method: PowerCON in and thru.

c. Inrush First Half-Cycle: 39 A at 120 V. 74 A at 240 V.
d. Wattage (Typical/Standby): 133 / 1.4 W at 120 V. 116 / 1.2 W at 230 V.
e. Current Draw: 1.11 A at 120 V. 1.11 A at 230 V.

7. Thermal: Operating Temperature: 32 to 104 degrees F.
   a. Fan: No. db Range: 18.5 dBa average at 39 inches.
   b. Droop Compensation: Yes.
   c. BTUs/hour: 453.
8. Physical: IP Rating: IP-20.
   a. Materials: Die-cast aluminum. Colors: Black, white, silver, or custom.
   b. Mounting Options: Yoke and floor.
   c. Included Accessories: Hanging yoke, power cable.

B. Basis of Design: ColorSource Linear as manufactured by ETC Inc. Combines output o with a sleek linear design creating a strip light. Uses RGB-L or bi-white color system.
1. Standards Compliance:
   a. Listed: cETLus, UL 1573, and CSA C22.2 No. 166.
   b. Compliance: CE and EAC.
2. Model ColorSource Linear 2. 1 meter long. Two cells of control.
3. Source:
   a. LED Details: 40 Lumileds LUXEON Z LEDs per segment.
   b. L70 Rating: 55,000 hours. Standard and DB.
4. Color:
   a. Color temperature Range: Standard and DB: Color mixing fixture.
   b. Calibrated Array: Yes.
   c. Red Shift: No.
5. Optical:
   a. Beam Angle Range: 15.6 degrees.
   b. Gate Size: N/A.
   c. Aperture Size: 7.5 inches.
   d. Pattern Projection: No.
   e. Pattern Size: N/A.
   f. Camera Flicker Control/Hz Range: Default: 1,200 Hz. RDM: 25,000 Hz.
6. Control:
   a. Input Method: DMX-512 via 5-pin XLR connector. Protocols: DMX512, RDM.
   b. RDM Configuration: Yes.
   c. User Interface Type: 7-segment address display, local level control via UI.
   d. Local Control: Yes.
   e. Onboard Presets: Yes, 12. Onboard Sequences: Yes, 5. Onboard Effects: No.
   f. Fixture-to-Fixture Control: Yes.
   g. 15-bit virtual dimming engine.
7. Electrical:
   a. Voltage: 100 to 240 Vac, 50 to 60 Hz.
   b. Input Method: PowerCON in and thru.
   c. Inrush First Half-Cycle: Linear 1 / Linear 2 / Linear 4.
      1) 35 A / 35.6 A / 67.5 A at 120 V. 49 A / 85.6 A / 153 A at 240 V.
   d. Wattage (120 Vac / 240 Vac): Linear 2: 218 / 213.
   e. Current Draw Linear 2: 1.82 A at 120 VAC. 0.91 A at 240 Vac.
8. Thermal: Operating Temperature: 32 to 104 degrees F.
   a. Fan: Yes. Not controllable.
   b. db Range Average at 39 inches: Linear 2: 28.4 dBA.
   c. Droop Compensation: Yes.
   d. BTUs/hour: (120 Vac / 240 Vac).
      1) Linear 2: 743.82 / 726.76.

9. Physical: IP Rating: IP-20.
    a. Materials: Die-cast alum. and plastic. Colors: Black, white, silver, or custom.
    b. Mounting Options: Yoke. 1 cell option. Trunnions.
    c. Included Accessories: Power cable and trunnions.

C. Basis of Design: ColorSource Spot V and ColorSource Spot VXT, manufactured by ETC Inc. Brings together a five-color light engine with the build-quality and support of an ETC product. Uses a mix of red, green, blue, indigo and lime LED emitters. ETC optics, adapters, and accessories.
1. Standards Compliance:
    a. Listed: cETLus, UL 1598, UL 924, CSA C22.2 No. 250.0.
    b. Compliance: CE.
2. Model ColorSource Spot V with shutter barrel, black.
3. Source:
    a. LED Details: 60 Lumileds LUXEON Rebel and LUXEON C LEDs.
    b. Max Lumens: 9300.
    c. Lumens per Watt: 47.2.
    d. L70 Rating: Greater than 54000 hours.
4. Colors:
    a. Colors Used Spot: Red, green, blue, indigo, lime.
    b. Color temperature Range: Color mixing.
    c. Calibrated Array: Yes.
    d. Red Shift: No.
5. Optical:
    a. Beam Angle Range: 5 to 90 degrees. Swappable lens tubes.
    b. Gate Size: 80 mm.
    c. Aperture Size: 6.25 to 14 inches depending on lend tube.
    d. Pattern Projection: Yes.
    e. Pattern Size: A or B.
    f. Camera Flicker Control/Hz Range: 5 kHz and 25 kHz.
6. Control:
    a. Input Method:
        1) DMX-512 via 5-pin XLR connector. Protocols: DMX512, RDM.
        2) City Theatrical Multiverse. Protocols: DMX512, RDM
    b. NFC Configuration: Yes, via Set Light app.
    c. RDM Configuration: Yes.
    d. User Interface Type:
        1) ColorSource Spot V: 7-segment 3 button interface.
    e. Local Control: Yes. (ColorSource Spot V only)
    f. Onboard Presets: Yes, 12. Onboard Sequences: Yes, 5. Onboard Effects: No.
    g. Fixture-to-Fixture Control: Yes.
    h. 15-bit virtual dimming engine.
7. Electrical:
    a. Voltage: 100 to 240 VAC, 50 to 60 Hz.
    b. Input Method: powerCON True1 TOP in and thru.
    c. Inrush First Half Cycle: 55 A at 120 V. 59 A at 240 V.
    d. Fixtures per Circuit:
        1) Eight. (R20 module or similar).
    e. Power Draw
        1) Wattage: Typical: 197. Standby: 2 at 120 V.
        2) Current Draw at 120 Vac: Typical: 1.65 A. Standby: 0.08 A.
8. Thermal: Operating Temperature: 32 to 104 degrees F.
    a. Fan: Yes. Controllable.
    b. Droop Compensation: Yes.

c. BTUs/hour: 671.77.

9. Physical: IP Rating: ColorSource Spot V: IP-20. ColorSource Spot VXT: IP-65
   a. Materials: Die-cast aluminum. Colors: Black, white, silver, or custom.
   b. Mounting Options: Yoke.
   c. Included Accessories: Hanging yoke, 39-inch power cable, soft-focus diffuser in an A-size gobo holder.

D. Basis of Design: ColorSource Fresnel V as manufactured by ETC Inc. An affordable high quality Fresnel wash fixture with motorized zoom. Uses RGBIL color system.
   1. Standards Compliance:
      a. Listed: cETLus, UL 1573, CSA C22.2 No. 166.
      b. Compliance: CE and EAC.
   2. Model ColorSource Fresnel V: Black
   3. Arrays:
      a. RGBIL (Red/Green/Blue/Indigo/Lime).
   4. Source:
      a. LED Details: 44 Lumileds LUXEON C LEDs
      b. Max. Lumens: 5,300.
      c. Lumens per Watt: 36.
      d. L70 rating: Greater than 54,000 hours.
   5. Color:
      a. Color temperature Range: Color mixing.
      b. Calibrated Array: Yes.
      c. Red Shift: No.
   6. Optical:
      a. Beam Angle Range: 13 to 44 degrees.
         1) Motorized zoom.
      b. Gate Size: N/A.
      c. Aperture Size: 7"
      d. Pattern Projection: No.
      e. Pattern Size: N/A.
      f. Camera Flicker Control/Hz Range: Default: 5kHz. RDM: 25,000 Hz.
   7. Control:
      a. Input Method: DMX-512 via 5-pin XLR connector. Protocols: DMX512, RDM, City Theatrical Multiverse, NFC.
      b. RDM Configuration: Yes.
      c. NFC Configuration: Yes
      d. User Interface Type: 7-segment 3 button, single encoder interface.
         1) Encoder controls local motorized zoom.
      e. Local Control: Yes.
      f. Onboard Presets: Yes, 12. Onboard Sequences: Yes, 5. Onboard Effects: No.
      g. Fixture-to-Fixture Control: Yes.
      h. 15-bit virtual dimming engine.
   8. Electrical:
      a. Voltage: 100 to 240 Vac, 50 to 60 Hz. Input Method: PowerCON True1 in and thru.
      b. Inrush First Half-Cycle:
      c. Fixtures per Circuit:
         1) 20 Amp Power-Thru Connector: Quantity of 8.
         2) R20 Module or Similar: Quantity of 9.
         3) Wattage at 120 Volts: 148.4 W.
         4) Wattage at 240 Vol: 147 W.
         5) Current Draw at 120 Volts: 1.28 Amps.
         6) Current Draw at 240 Volts: 10.70 Amps.

9. Thermal: Operating Temperature: 32 to 104 degrees F.
    a. Fan: Yes. Not controllable. dB Range: 22.9 dBA average at 39 inches.
    b. Droop Compensation: Yes.
10. Physical: IP Rating: IP-20.
    a. Materials: Die-cast aluminum. Colors: Black, white, silver, or custom.
    b. Mounting Options: Yoke or floor stand.
    c. Included Accessories: Power cable and hanging yoke.
    d. Seven-segment, three-button Interface.

2.12 ENTERTAINMENT FOLLOWSPOT

A. Basis of Design: CantoUSA Astro 600 LED Follow spot 3000K.
1. Astro 600 3200K Follow spot Fixture with 8–22-degree zoom
2. Iris
3. Lamp (LED light Engine with 10-year warranty on the light array)
4. Tripod Stand
5. 6 Color Boomerang
6. Power Cable w/ 15A Edison
7. 7.25” Round Gel Pack (5 colors)
8. 28mm spigot
9. Provide with optional tripod casters.
10. Provide (2) Follow spots for Auditorium.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation of this equipment shall only be performed by manufacture approved and factory trained theatrical rigging installers. Installation shall be performed in a workmanlike manner and shall strictly adhere to the standards of these specifications and manufacture’s installation requirements. Where necessary, the installer shall adjust to accommodate unforeseen impediments to installation. The completed work must achieve all electrical, safety and appearance requirements as established in these specifications. Install all new equipment in compliance with national and local electrical codes. The auxiliary equipment required to make this installation comply with codes, even if not listed in the specification, is the responsibility of the contractor.

B. All wiring shall be done in a craftsman-like manner. When conductors must be spliced to extend length, it shall be done with a terminal strip or suitable type compression fittings.

C. Equipment shall be kept clear of all metal shavings, wire scraps, and miscellaneous trash. Any abandoned holes in the floor shall be patched.

D. Any existing conduit emanating from the floor shall be dressed in such a manner as to eliminate any trip hazard. Conduits shall be re-routed or terminated into wireways to insure a neat installation.

E. All equipment shall be installed in compliance with applicable local and national codes. It shall also be installed in accordance with the manufacturer's recommendations. Prior to initial energizing, a factory certified technician shall inspect the system and any errors shall be corrected.

F. Pipes positions shall be rigidly fixed, and conduit shall be flexible, following the hanging points. Conduit shall not obstruct the pipe: it shall be possible to add additional portable fixtures anywhere on the pipe position without obstruction.

G. Provide all lighting fixtures and accessories as indicated or required. All portable fixtures shall be unboxed, lamped, hung on pipe positions, tested, and focused for an even stage wash. Safety cables shall be installed around fixture yoke and pipe position. Data cables shall be installed to connect all fixtures to DMX as needed, with excess cable tied neatly to pipe.

H. Portable lighting console and cables shall be tested and provided for the system energization and training and then turned over to the Owner.

I. Work shall be performed in accordance with OSHA and local codes.

II.

J. On site welding shall only be performed per AWS D1.1 standards and with advanced approval from the Architect and Owner's representative.

3.2 COMMISSIONING

A. Operational Tests: Energize lighting controls systems, program controls, and check controlled outlets for light levels. Program test scenes so every fixture is tested throughout its operating range. Check programmed function at each control station. Adjust components and revise installation to correct deficiencies.

B. Correct deficiencies and retest deficient items. Verify by the system tests that specified requirements are met.

END OF SECTION

SECTION 26 56 67

SPORTS FIELD LIGHTING SYSTEM

PART 1 – GENERAL

1.1 SUMMARY

A. Work covered by this section of the specifications shall conform to the contract documents, engineering plans as well as state and local codes.

B. The purpose of these specifications is to define the lighting system performance and design standards for athletic fields using an LED Lighting source. The manufacturer / contractor shall supply lighting equipment to meet or exceed the standards set forth in these specifications. Basis of design manufacture: Musco.

C. The sports lighting will be for the following venues:
   1. Tennis

D. The primary goals of this sports lighting project are:
   1. Guaranteed Light Levels: Selection of appropriate light levels impact the safety of the players and the enjoyment of spectators. Therefore, light levels shall be guaranteed to not drop below specified target values for a period of 25 years from date of delivery of equipment to the site.
   2. Environmental Light Control: It is the primary goal of this project to minimize spill light to adjoining properties and glare to the players, spectators, and neighbors.
   3. Life-cycle Cost: In order to reduce the operating budget, the preferred lighting system shall be energy efficient and cost effective to operate. All maintenance costs shall be the responsibility of the manufacturer as indicated and included at no additional cost to the Owner for the duration of the warranty.
   4. Control and Monitoring: Provide a remote on/off control system for the lighting system. Fields shall be proactively monitored to detect luminaire outages over the 25-year life cycle. All communication and monitoring costs for 25-year period shall be included at no additional cost to the Owner.

E. All lighting designs shall comply with local lighting ordinances.

1.2 SPECIFICATION COMPLIANCE REVIEW

A. Provide a complete written, item-by-item specification review indicating compliance or deviation in full description.

B. 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 with the product data.

1.3 WARRANTY AND GUARANTEE

A. 25-Year Warranty: Manufacturer shall provide a signed warranty covering the entire

system for 25 years from the date of delivery to the site. The warranty shall guarantee specified light levels. The manufacturer shall maintain specifically funded financial reserves to assure fulfillment of the warranty for the full term. Warranty does not cover acts of God, weather conditions events such as lightning or hail damage, improper installation, vandalism or abuse, unauthorized repairs or alterations, or products made by other manufacturers.

B. Maintenance: Manufacturer shall monitor the performance of the lighting system, including on/off status, hours of usage and luminaire outage for 25 years from the date of equipment shipment. Parts and labor shall be covered such that individual luminaire outages will be repaired when the usage of any field is materially impacted. Manufacturer shall provide all preventative and spot maintenance, including parts and labor for 25 years from the date of equipment shipment. Individual outages shall be repaired when the usage of any field is materially impacted. In event of an outage, Owner shall verify for the manufacturer that power is available to each lighting circuit controller, fuses , and lighting contactors.

PART 2 – PRODUCTS

2.1 ILLUMINATION PERFORMANCE REQUIREMENTS

A. Illumination Levels and Design Factors: Playing surfaces shall be lit to an average target illumination level and uniformity as specified in the chart below. Lighting calculations shall be developed, and field measurements taken on the grid spacing with the minimum number of grid points specified below. Appropriate light loss factors including but not limited to dirt depreciation and optical material deterioration shall be applied and submitted for the basis of design. Average illumination level shall be measured in accordance with the IESNA LM-5-04 (IESNA Guide for Photometric Measurements of Area and Sports Lighting Installations). Illumination levels shall not drop below desired target values in accordance to IES RP-6-15, Page 2, Maintained Average Illuminance and shall be guaranteed for the full warranty period. Due to various dimensions of some athletic fields the actual quantity of grid points may vary, however the grid spacings shall be taken over the entire playing surface and the exact quantity adjusted accordingly.

Area of Lighting: Average annual usage	Average Target Illumination Levels	Maximum to Minimum Uniformity Ratio	Minimum Grid Points	Grid Spacing
Tennis	50 foot-candles	1.5:1.0	60/court	20’ x 20’

B. Color: The lighting system shall have a color temperature of 4000K-5700K and a minimum CRI of 75.

C. Mounting Heights: To ensure proper aiming angles for reduced glare and to provide better playability, minimum mounting heights shall be as described below. Provide mounting heights as required based on pole locations and setback from the field of play. Higher mounting heights may be required based on photometric report and ability to ensure the top of the field angle is a minimum of 10 degrees below horizontal.

D. Aiming of any luminaire shall not be greater than 60 degrees from nadir.

E. Center of luminaire cluster height at top of light poles: Typical average mounting height of a light cluster H = [(1/3 W) + SB} x tan 30. Width (W)]= width of playing surface from foul line or inbound/outbound line to the opposite foul line or inbound/outbound line in the direction of the principal aiming of respective light standard pole. Pole Set Back (SB) = the distance from the nearest foul line or inbound/outbound line to the proposed light standard pole location.

F. Unless indicated otherwise the center of an individual luminaire cluster's mounting height shall be as recommended by IES due to pole set back but in no case, shall any aiming angle of any luminaire aimed to the sports field exceed 60 degrees from nadir.

2.2 ENVIRONMENTAL LIGHT CONTROL

A. Light Control Luminaires: All luminaires shall utilize spill light and glare control devices including, but not limited to, optical lensing, internal shields, louvers, or external shields.

B. The first page of a photometric report for all luminaire types proposed showing horizontal and vertical axial candle power shall be provided to demonstrate the capability of achieving the specified performance. Reports shall be certified by a qualified independent testing laboratory with a minimum of five years' experience or by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products. A summary of the horizontal and vertical aiming angles for each luminaire shall be included with the photometric report.

2.3 SPORTS LIGHTING SYSTEM CONSTRUCTION

A. Manufacturing Requirements: All components shall be designed and manufactured as a system. All luminaires, wire harnesses, drivers and other enclosures shall be factory assembled, aimed, wired and tested prior to shipment.

B. Durability: All exposed components shall be constructed of corrosion resistant material and/or coated to help prevent corrosion. All exposed carbon steel shall be hot dip galvanized per ASTM A123. All exposed aluminum shall be powder coated with high performance polyester or anodized. All exterior reflective inserts shall be anodized, coated, and protected from direct environmental exposure to prevent reflective degradation or corrosion. All exposed hardware and fasteners shall be stainless steel of 18-8 grade or better, passivated and coated with aluminum-based thermosetting epoxy resin for protection against corrosion and stress corrosion cracking. Structural fasteners may be carbon steel and galvanized meeting ASTM A153 and ISO/EN 1461 (for hot dipped galvanizing), or ASTM B695 (for mechanical galvanizing). All wiring shall be enclosed within the cross-arms, pole, or electrical components enclosure.

C. System Description: Lighting system shall consist of the following:
   1. Galvanized steel poles with maintenance platform/cage, climbing pegs, and cross-arm assembly.
   2. Non-approved pole technology:
      a. Square static cast concrete poles will not be accepted.
      b. Direct bury steel poles which utilize the extended portion of the steel shaft for their foundation will not be accepted due to potential for internal and external corrosive reaction to the soils and long-term performance concerns.
   3. Lighting systems shall use concrete foundations.

a. For a foundation using a pre-stressed concrete base embedded in concrete backfill, the concrete shall be air-entrained and have a minimum compressive design strength at 28 days of 3,000 PSI. 3,000 PSI concrete specified for early pole erection, actual required minimum allowable concrete strength is 1,000 PSI. All piers and concrete backfill must bear on and against firm undisturbed soil.
b. For anchor bolt foundations or foundations using a pre-stressed concrete base in a suspended pier or reinforced pier design pole, erection may occur after 7 days, or after a concrete sample from the same batch achieves a specified strength approved by the structural engineer.

4. Manufacturer shall supply all LED drivers and supporting electrical equipment
   a. Remote drivers and supporting electrical equipment shall be mounted approximately 10 feet above grade in aluminum NEMA 3RX enclosures. The enclosures shall be touch-safe and include drivers and fusing with indicator lights on fuses to notify when a fuse is to be replaced for each luminaire. Disconnect per circuit for each pole structure shall be located in the enclosure.
5. Manufacturer shall provide surge protection at the pole equal to or greater than 40 kA for each line to ground (Common Mode) as recommended by IEEE C62.41.2_2002.
6. Wire harness shall be complete with an abrasion protection sleeve, strain relief and plug-in connections for fast, trouble-free installation.
7. All luminaires, visors, and cross-arm assemblies shall withstand 150 mph winds and maintain luminaire aiming alignment.
8. Control cabinet shall provide remote on-off control and monitoring of the lighting system.
9. Manufacturer shall provide lightning protection and grounding as defined by NFPA 780 and be UL Listed per UL 96 and UL 96A.
   a. Integrated grounding via concrete encased electrode grounding system.
   b. If grounding is not integrated into the structure, the manufacturer shall supply grounding electrodes, copper down conductors, and exothermic weld kits. Electrodes and conductors shall be sized as required by NFPA 780.The grounding electrode shall be minimum size of 5/8 inch diameter and 8 feet long, with a minimum of 10 feet embedment. Grounding electrode shall be connected to the structure by a grounding electrode conductor with a minimum size of 2 AWG for poles with 75 feet mounting height or less, and 2/0 AWG for poles with more than 75 feet mounting height.

D. Safety: All system components shall be UL listed for the appropriate application.

2.4 ELECTRICAL

A. Electric Power Requirements for the Sports Lighting Equipment:
   1. Maximum total voltage drop: Voltage drop to the disconnect switch located on the poles shall not exceed three (3) percent of the rated voltage.

B. Equipment requiring electrical distribution more than that indicated or required by the basis of design shall be provided by the contractor at no additional cost to the Owner.

2.5 STRUCTURAL PARAMETERS

A. Wind Loads: Wind loads shall be based on the latest published edition of the International Building Code and all local code requirements. Wind loads shall be calculated using ASCE 7-10, an ultimate design wind speed of 120 mph and exposure category C.

B. Manufacturer Pole Structural Design: The stress analysis and safety factor of the poles shall conform to the latest published edition of AASHTO Standard Specification for Structural Supports for Highway Signs, Luminaires, and Traffic Signals (LTS-5).

C. Manufacturer Foundation Design: The foundation design shall be based on soil parameters as outlined in the geotechnical report. If a geotechnical report is not utilized, the foundation design shall be based on class 5 soils.

D. Manufacturer Foundation Drawings: Project specific foundation drawings stamped by a registered engineer in the state where the project is located are required. The foundation drawings must list the moment, shear (horizontal) force, and axial (vertical) force at ground level for each pole.

2.6 CONTROL

A. Instant On/Off Capabilities: System shall provide for instant on/off of luminaires. Contactors shall be rated 60A/3P to utilize existing 40 Amp feeder circuits.

B. Lighting contactor cabinet(s) constructed of minimum NEMA Type 3RX aluminum, designed for easy installation with contactors, labeled to match field diagrams and electrical design. Manual off-on-auto (momentary ON/OFF reverting to the AUTO position) rotary (non-keyed) selector switches shall be provided. The system shall be programmed for manual ON/OFF operation only.

C. Remote Lighting Control System: System shall allow Owner and users with a security code to schedule on/off system operation via a web site, phone, fax, or email up to ten years in advance. Manufacturer shall provide and maintain a two-way TCP/IP communication link. Trained staff shall be available 24/7 to provide scheduling support and assist with reporting needs.
   1. The owner may assign various security levels to schedulers by function and/or fields. This function must be flexible to allow a range of privileges such as full scheduling capabilities for all fields to only having permission to execute “early off” commands. The scheduling tool shall be capable of setting curfew limits.
   2. Controller shall accept and store 7-day schedules, be protected against memory loss during power outages, and shall reboot once power is regained and execute any commands that would have occurred during outage.

D. Remote Monitoring System: System shall monitor lighting performance and notify manufacturer if individual luminaire outage is detected so that appropriate maintenance can be scheduled. The controller shall determine switch position (manual or auto) and contactor status (open or closed).

E. Management Tools: Manufacturer shall provide a web-based database and dashboard tool of actual field usage and provide reports by facility and user group. Dashboard shall also show current status of luminaire outages, control operation, and service. Mobile applications shall be provided suitable for IOS, and Android devices.

F. Hours of Usage: Manufacturer shall provide a means of tracking actual hours of usage

for the field lighting system that is readily accessible to the owner.
1. Cumulative hours: shall be tracked to show the total hours used by the facility
2. Report hours saved by using early off and push buttons by users.

G. Communication Costs: Manufacturer shall include communication costs for operating the controls and monitoring system for a period of 25 years.

2.7 CONTROL OF EXISTING NON-MUSCO LIGHT POLES

A. Provide three additional controlled 60A/3P lighting contactors for control of existing HID tennis court lighting. Include spare cabinet space as needed for future equipment/controls for monitoring of these three additional contactor circuits for future HID replacement to Musco LED.

PART 3 – EXECUTION

3.1 SOIL QUALITY CONTROL

A. It shall be the Contractor's responsibility to notify the Architect/Engineer/Owner immediately if unforeseen soil conditions exist other than those on which the foundation design is based or indicated in the project's Geotechnical Report, or if the soil cannot be readily excavated.
1. Provide engineered foundation embedment design by a registered engineer in the State where the project is located for soils other than specified soil conditions.
2. Provide additional materials required to achieve alternate foundation design.
3. Excavate and remove from the site materials other than normal soils, such as rock, caliche, etc.

3.2 FIELD QUALITY CONTROL

A. Illumination Measurements: Upon substantial completion of the project and in the presence of the Contractor, Project Engineer, Owner's Representative, and Manufacturer's Representative, illumination measurements shall be taken and verified. The illumination measurements shall be conducted in accordance with IESNA LM-5-04.

B. Field Light Level Accountability
1. Light levels shall be guaranteed not to fall below the target maintained light levels for the entire warranty period of 25 Years.
2. The contractor/manufacturer shall be responsible for an additional inspection one year from the date of substantial completion or commissioning of the lighting system and shall also utilize the Owner's light meter in the presence of the Owner at the Owner's request.
3. The contractor/manufacturer shall make all changes needed to bring the fields back to compliance for light levels and uniformities. Contractor/Manufacturer shall be held responsible for any damage to the fields during these repairs and make repairs to the satisfaction of the Owner at no additional cost.

C. Correcting Non-Conformance: If, in the opinion of the Owner or his appointed Representative, the actual performance levels including foot-candles and uniformity ratios are not in conformance with the requirements of the performance specifications and submitted information, the Contractor/Manufacturer shall make all adjustments required to meet specifications and satisfy the Owner at no additional cost to the Owner.

END OF SECTION

SUBMITTAL INFORMATION
Design Submittal Data Checklist and Certification
All items listed below are mandatory, shall comply with the specification and be submitted according to pre-bid submittal requirements

Included	Tab	Item	Description
	A	Letter/ Checklist	Listing of all information being submitted must be included on the table of contents. List the name of the manufacturer's local representative and his/her phone number. Signed submittal checklist to be included.
	B	On Field Lighting Design	Lighting design drawing(s) showing: a. Field Name, date, file number, prepared by, and other pertinent data b. Outline of field(s) being lighted, as well as pole locations referenced to the center of the field (x & y), or home plate for baseball / softball fields. Illuminance levels at grid spacing specified c. Pole height, number of fixtures per pole, as well as luminaire information including wattage, lumens and optics d. Height of meter above field surface e. Summary table showing the number and spacing of grid points; average, minimum and maximum illuminance levels in foot candles (fc); uniformity including maximum to minimum ratio, coefficient of variance and uniformity gradient; number of luminaries, total kilowatts, average tilt factor; light loss factor. f. Alternate manufacturers shall provide both initial and maintained light scans using a maximum 0.70 Light Loss Factor to calculate maintained values.
	C	Off Field Lighting Design	Lighting design drawings showing spill light levels in footcandles as specified in section 1.3 A.
	D	Photometric Report	Provide photometric report for a typical luminaire used showing candela tabulations as defined by IESNA Publication LM-35-02. Photometric data shall be certified by laboratory with current National Voluntary Laboratory Accreditation Program or an independent testing facility with over 5 years experience.
	E	Life Cycle Cost calculation	Document life cycle cost calculations as defined in the specification. Identify energy costs for operating the luminaires, maintenance cost for the system including spot lamp replacement, and group relamping costs. All costs should be based on 25 Years.
	F	Luminaire Aiming Summary	Document showing each luminaire's aiming angle and the poles on which the luminaries are mounted. Each aiming point shall identify the type of luminaire.
	G	Structural Calculations	Pole structural calculations and foundation design showing foundation shape, depth backfill requirements, rebar and anchor bolts (if required). Pole base reaction forces shall be shown on the foundation drawing along with soil bearing pressures. Design must be stamped by a structural engineer in the state of Texas.
	H	Control and Monitoring	Manufacturer shall provide written definition and schematics for automated control system to include monitoring. They will also provide examples of system reporting and access for numbers for personal contact to operate the system.
	I	Electrical distribution plans	If bidding an alternate system, manufacturer must include a revised electrical distribution plan including changes to service entrance, panels and wire sizing, signed by a licensed Electrical Engineer in the state of Texas.
	J	Performance Guarantee	Provide performance guarantee including a written commitment to undertake all corrections required to meet the performance requirements noted in these specifications at no expense to the owner. Light levels must be guaranteed per specification for 25 years. Constant light systems shall provide independent 3rd party test data stamped by a registered engineer.
	K	Warranty	Provide written warranty information including all terms and conditions.

	L	Project References	Manufacturer to provide a list of project references of similar products completed within the past three years.
	M	Product Information	Complete set of product brochures for all components, including a complete parts list and UL Listings.
	N	Non-Compliance	Manufacturer shall list all items that do not comply with the specifications.
	O	Compliance	Manufacturer shall sign off that all requirements of the specifications have been met at that the manufacturer will be responsible for any future costs incurred to bring their equipment into compliance for all items not meeting specifications and not listed in item N – Non-Compliance

Manufacturer: **Signature:**

Contact Name: **Date: _____/_____/_____**

SECTION 27 01 00

OPERATION AND MAINTENANCE (O&M) MANUALS OF COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Compile product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare operating and maintenance data as specified in this Section and as referenced in other sections of specifications.

B. Instruct Owner's personnel in operation and maintenance of equipment and systems.

C. Submit three (3) electronic copies, on separate devices (USB Flash Drive or some type of pre-approved solid-state storage device), of complete O&M manuals in final form. The submitted manual shall be the system manufacturer’s operations manual, supplemented with operations and maintenance instructions custom tailored for the system installed. Electronic documentation shall be provided in a non-proprietary PDF format, without password restrictions.

D. Hard copies shall be provided upon request of the Owner, Architect, and/or Consultant.

E. Recorded video of all training sessions shall be included in each copy, of each system’s final submitted O&M.

F. The final submitted manual shall include a sing-in sheet and owner/consultant signed acceptance of all training sessions.

1.2 ELECTRICAL OPERATING AND MAINTENANCE MANUAL SUBMITTAL SCHEDULE

A. Thirty (30) days after receipt of reviewed submittals bearing the Project Technology Consultant’s stamp of acceptance (including re-submittals), submit for review, an electronic copy of the first draft of the System’s O&M Manual. This copy shall contain as applicable to the specific system, a minimum of the following:

1. Table of Contents for each element
2. Contractor information
3. All shop drawings, coordination drawings and product data, bearing the Project technology Consultant’s stamp of acceptance.
4. All parts and maintenance manuals for items of equipment
5. Warranties (without starting dates)
6. Certifications that have been completed; submit forms and outlines of certifications that have not been completed
7. Operating and maintenance procedures.
8. Form of Owner's Training Program Syllabus (including times and dates)
9. Control operations / equipment wiring diagrams
10. Coordination Drawings
11. Schedule of Speakers, Amplifiers, Sound Equipment, Etc.
12. Schedule of Handsets and other Peripheral Devices, Etc.
13. Schedule of Cable, Jacks, Outlets, Etc.
14. Access Control Door Schedules
15. Video Surveillance Camera Schedules

16. Other required operating and maintenance information that are complete.
17. Cable pathway layout drawings and station map, including through wall and floor penetration locations and sleeve sizes.

B. Copy will be returned to the Contractor within 15 days with comments for corrections.

C. Submit the electronic completed manuals (hard copies upon request) in final form to the Project's Technology Consultant.
1. Prior to substantial completion for Owner's use after the Owner accepts facility maintenance.
2. Include all specified data, test reports, drawings, dated warranties, certificates, training videos. along with other materials and information.

D. The Project's Technology Consultant shall review the manuals for completeness within 15 days.

E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Project's Technology Consultant. The manuals will not be retransmitted.

F. Electronic and/or hard copies of the accepted manuals shall be delivered to the Owner prior to substantial completion.

PART 2 - PRODUCTS

2.1 BINDERS

A. Upon the request for hard copies of the O&M manuals, the binders shall consist of the following configuration:
1. Commercial quality black, 3-ring binders with clear, durable, cleanable plastic covers.
2. Minimum ring size: 1"; Maximum ring size: 3".
3. When multiple binders are used, correlate the data into related groupings.
4. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

3.1 SYSTEM OPERATION AND MAINTENANCE MANUAL

A. Form for Manuals Submitted in Hard Copy Format:
1. Prepare data in form of an instructional manual for use by Owner's personnel.
2. Format:
   a. Size: 8-1/2" x 11"
   b. Text: Manufacturer's printed data or neatly typewritten.
3. Drawings:
   a. Provide reinforced punched binder tab and bind in text.
   b. Fold larger drawings to size of text pages.
4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
   a. Title of Project
   b. Identity of separate structures as applicable
   c. Identity of general subject matter covered in the manual.

6. Binder as specified

B. Content of Manual:
   1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
      a. Contractor, name of responsible principal, address and telephone number
      b. A list of each product required to be included, indexed to content of the volume.
      c. List with each product, name, address and telephone number of:
         1) Subcontractor or installer
         2) Maintenance contractor as appropriate
         3) Identify area of responsibility of each.
         4) Local source of supply for parts and replacement
      d. Identify each product-by-product name and other identifying symbols as set forth in Contract Documents.
   2. Product Data:
      a. Include those sheets pertinent to the specific product.
      b. Annotate each sheet to:
         1) Identify specific product or part installed.
         2) Identify data applicable to installation.
         3) Delete references to inapplicable information.
   3. Drawings:
      a. Supplement product data with drawings as necessary to illustrate:
         1) Relations of component parts of equipment and systems
         2) Control and flow diagrams
      b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
      c. Do not use Project Record Documents as maintenance drawings.
   4. Written text as required to supplement product data for the particular installation:
      a. Organize in consistent format under separate headings for different procedures.
      b. Provide logical sequence of instructions for each procedure.
   5. Copy of each warranty, bond and service contract issued
      a. Provide information sheet for Owner's personnel, giving:
         1) Proper procedures in event of failure
         2) Instances that might affect validity of warranties or bonds
   6. Shop drawings, coordination drawings and product data as specified.

C. Sections for Equipment and Systems
   1. Content for each unit of equipment and system as appropriate:
      a. Description of unit and component parts:
         1) Function, normal operating characteristics, and limiting conditions.
         2) Performance curves, engineering data and tests.
         3) Complete nomenclature and commercial number of replaceable parts.
      b. Operating procedures:
         1) Start up, break-in, routine / normal operating instructions
         2) Regulation, control, stopping, shut down and emergency instructions
         3) Special operating instructions
      c. Maintenance procedures:
         1) Routine operations

2) Guide to trouble-shooting
3) Disassembly, repair and reassembly
4) Alignment, adjusting and checking
5) Routine service based on operating hours

d. Manufacturer's printed operating and maintenance instructions.
e. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
f. Complete equipment field accessible wiring diagrams
g. Each Contractor's coordination drawings
h. Other data as required under pertinent sections of the specifications

2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications
4. Provide complete information for products specified in Division 27.
5. Provide certificates of compliance as specified in each related section.
6. Provide start up reports as specified in each related section.
7. Provide signed receipts for spare parts and material.
8. Provide training report and certificates.

END OF SECTION

SECTION 27 05 00

COMMUNICATIONS BASIC MATERIALS, METHODS, AND GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of Division 01 General Requirements, and other provisions and requirements of the Contract Documents apply to work of Division 27 Communications.

B. Applicable provisions of this section apply to all sections of Division 27, Communications.

C. The general provisions of the Contract and the requirements of the following Sections apply to the Work specified in this Section. See following sections for related general and specific requirements following sections shall associate with this specification as applicable.
   1. Division 26 in its entirety.
   2. Division 27 in its entirety.
   3. Division 28 in its entirety.

D. The entire drawing and specification package apply to the work specified in the communication specifications and shall be complied with in every respect. The Contract Documents are comprised of the drawings and specifications. The Contractor shall examine these Contract Documents, and coordinate required work indicated in each.

1.2 CODES AND STANDARDS

A. All equipment and work performed shall comply with current and applicable Codes, Standards, Rules, Ordinances, Regulations, and Best Practices (both published and best practices) as well as any other authorities that may have lawful jurisdiction pertaining to the work specified. None of the terms or provisions of this specification shall be construed as waiving any of the rules, regulations, or requirements of these authorities (including those not specifically listed in this Specification). Applicable Codes and Standards shall consist of, but not be limited to the following:
   1. Americans with Disabilities Act (ADA)
   2. Authorities Having Jurisdiction (AHJ) - Local
   3. American National Standards Institute (ANSI)
   4. American Society of Testing and Materials (ASTM) *Communications Cables - B694, B736, D4565, D4566, D4730, D4731, D4732*
   5. Building Industry Consulting Services International (BICSI)
   6. Code of Federal Regulations - Title 47
   7. Electronics Industries Association (EIA) *Standard Test Procedures for Fiber Optic Fibers, Cables, Transducers, Connecting and Terminating Devices - EIA-455 Series*
   8. Federal Communications Commission (FCC) - Communications Act and FCC Rules
   9. Federal Information Processing Standards (FIPS) *Federal Building Standard for Telecommunications Pathways and Spaces - FIPS PUB 175, FIPS PUB 176*
   10. The Insulated Cable Engineers Association (ICEA) *Communications Cable*

Stands - P-47-434, S-56-434, S-80-576, S84-608, S-85-625, S-86-634, S-87-640, S-89-648, S-90-661, S-98-688, S-99-689, S-100-685

11. International Electro-technical Commission (IEC)
12. Institute of Electrical and Electronic Engineers (IEEE) *Local Area Networks/Metropolitan Networks Standards Collection - LAN/MAN 802 Series*
13. International Organization for Standardization (ISO) (ISO/IEC) *Premise Wiring Core and LAN/MAN Core Equivalents-11801, 8802, 14763-1*
14. International Telecommunication Union (ITU-T) *Telecommunications Standardization*
15. National Electrical Code (NEC) *National Electrical Code - NFPA 70*
16. National Electrical Contractor's Association (NECA) *Standards of Installation*
17. National Electrical Manufacturers Association (NEMA) *Performance Standard for Twisted Pair Premise Voice and Data Communications Cable-WC 63.1, WC 63.2, WC 66*
18. National Electrical Safety Code (NESC)
19. National Fire Protection Association (NFPA) - *National Fire Alarm Code NFPA 72, Life Safety Code NFPA 101*
20. Society of Cable Telecommunications Engineers (SCTE)
21. Local Accessibility Standards
22. Telecommunications Industries Association (TIA) *(ANSI/TIA/EIA) Wiring and Cabling Standards - 526, 568, 569, 570, 571, 598, 606, 607, 758, TSB 31-B, 63, 67, 72, 75 and 95*
23. Uniform Building Code (UBC)
24. Underwriters Laboratories, Inc. (U.L.) - *497A, 910, 1077, 1863, 1283, 1459, 1604, 1651, 1681, 1690, 1778, 1977*

B. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.

C. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.

D. Obtain all permits required.

1.3 SUMMARY

A. The work covered by the specifications includes furnishing materials, labor, transportation, tools, permits, fees, utilities, and incidentals necessary for the complete installation of work required in the Contract Drawings.

B. It is the intent of the Contract Documents to provide a new and/or an extension of the existing installation, as shown in the associated specifications and drawings, complete in every respect.

C. Provide complete and working Communications Systems including equipment, conduit, wiring, material, labor and training as described in this Specification and the Drawings. The Communications Systems Drawings and Specifications are the sole property of the Architect and are not to be duplicated, scanned, loaned or in any way made available to persons not designated as authorized by the Architect. All Communications Systems plans, and specifications are to be returned to the Architect following completion of bid.

1.4 CONTRACTOR'S QUALIFICATIONS

A. An approved contractor for the work under this division shall be:
   1. A specialist in this field and have the personnel, experience, training, and skill, and the organization to provide a practical working system.
   2. Able to furnish evidence of having contracted for and installed not less than ten (10) systems of comparable size and type that have served their Owners satisfactorily for not less than 3 years.
   3. Perform work by persons qualified to produce workmanship of specified quality. Persons performing work shall be required to be licensed. Onsite supervision shall have minimum of the following:
      a. Licenses, as applicable to the system being installed
      b. Manufacturer's Certifications
         1) Firm Certification
         2) Installer Certification
         3) Programmer's Certification
         4) System Designer Certification.

1.5 DRAWINGS AND SPECIFICATIONS

A. The drawings and these specifications are complementary to each other, and what is required by one shall be as binding as if required by both.

B. If variations or departures from the drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore shall be submitted to the Consultant for review. No departures shall be made without prior written acceptance of the Consultant.

C. Should the drawings or specifications disagree in themselves or with their counterpart, the better quality or greater quantity of work or materials shall be estimated upon, and unless otherwise directed by the Consultant in writing, shall be performed or furnished. In the case that the specifications should not fully agree with the Schedules, the latter shall govern. Figures indicated on drawings govern scale measurements and large-scale details govern small scale drawings.

D. The approximate locations of system equipment and components are indicated on the Drawings. These Drawings are not intended to give complete and accurate details in regard to location of equipment, field devices, etc. Exact locations are to be determined by actual measurements at the building and will in all cases be subject to the Review of the Owner or Consultant, who reserves the right to make any reasonable changes in the locations indicated without additional cost to the Owner.

E. Items specifically mentioned in the Specifications but not shown on the Drawings and/or items shown on Drawings but not specifically mentioned in the Specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.

F. Any discrepancies between the Contract Documents and actual job site conditions shall be reported to the Owner or Consultant, so that they will be resolved prior to the bidding, where this cannot be done at least 7 working days prior to bid; the greater or costlier of the discrepancy shall be bid. All labor and materials required to perform the work described shall be included as part of this Contract.

G. It is the intention of this Section of the Specifications, and associated drawings, to outline minimum requirements to furnish the Owner with a turnkey and fully operating system in cooperation with other trades.

H. The contract documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the shop drawings accepted by project's consultant.

I. The Contractor shall be responsible for coordination and proper relation of his work to the building structure and to the work of all trades. The Contractor shall visit the premises and thoroughly familiarize himself with the existing site conditions, details of the work and the working conditions, and verify dimensions in the field. The Contractor shall advise the project's consultant of any discrepancy prior to bidding. The submission of bids shall be deemed evidence of the Contractor's site visit; coordination of existing conditions and include consideration for existing conditions.

J. These documents are conceptual in nature. It shall be the responsibility of the approved installer to furnish a complete and functional system, including the items shown on the drawings, in the specifications, and items not designated in either. The installer's shop drawings and product data submittals shall represent a complete system and documents accepted by the project's consultant shall not relieve the installer from being required to provide any materials, equipment, or labor to furnish a complete and functional system as recognized by the Project's Technology Consultant and the Owner.

1.6 BUILDING CONSTRUCTION AND LAYOUT OF WORK

A. General: It shall be the responsibility of the Contractor to consult the Engineering Drawings and Details so as to thoroughly familiarize himself with the type and quality of construction to be provided on this project.

B. The drawings are diagrammatic in nature and do not show every connection in detail or every line or conduit in its exact location. These details are subject to the requirements of all codes, ordinances, and standards; as well as all structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be laid out so that it will be concealed in closed ceiling space and/or furred chases unless specifically noted or indicated to be exposed. Work shall be installed to avoid crippling of structural members. All work shall be run parallel or perpendicular to the lines of the building unless otherwise noted.

C. The approximate location of equipment items is indicated on the drawings. Exact locations are to be determined by coordination of dimensions from approved equipment submittals and site-verified field measurements and will in all cases be subject to the approval of the Consultant. The Consultant reserves the right to make any reasonable changes in the indicated locations prior to installation for no additional cost.

D. In areas of existing special ceiling construction, the removal and restoration must be carefully planned such that the existing condition of the ceilings is maintained. It may be necessary for the Contractor to procure a Subcontractor familiar with this work to achieve this requirement.

E. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.7 RELATION WITH OTHER TRADES

A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements. Extend electrical services and final connections to all items requiring same.

B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.

C. Where cabling pass through walls or floors, metal sleeves shall be provided and shall be sealed to prevent spread of fire and smoke. In walls, they shall extend 3” beyond the finished surface. In pipe chases, they shall extend 8” inches above floor slab and be cemented in a watertight manner. Size of these sleeves shall be at least as required to maintain a maximum 40% conduit fill ratio.1/2 inch greater than outside diameter of the conduit.

D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.

E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under other Division. Determine from the General Contractor / Construction Manager for the various trades, the Owner, and by direction from the Architect / Engineer, the exact location of all items. The construction trades involved shall furnish all roughing-in drawings and wiring diagrams required for proper installation of the electrical work.
   1. Make final connections to all communications equipment indicated on the drawings, except as noted.

F. Request all Shop Drawings required in ample time to permit proper installation of all electrical provisions.

G. Extend services as indicated to the various items of equipment furnished by others. Rough-in for the various items and make final connections ready for operation upon placing of the equipment.

1.8 CONCEALED AND EXPOSED WORK

A. When the word "concealed" is defined as hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is defined as open to view, in plain sight.

1.9 GUARANTEE

A. Guarantee work for a minimum of two years or as noted longer elsewhere from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.10 MATERIAL AND EQUIPMENT

A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same

type or class of equipment are required, provide units of a single manufacturer.

1.11 NOISE AND VIBRATION

A. Select equipment to operate with minimum noise and vibration. If noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, and judged objectionable by the Owner, Architect, or Engineer, rectify such conditions at no additional cost to the Owner. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.12 ACCEPTABLE MANUFACTURERS

A. Manufacturers names and catalog number specified under sections of Division 27 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer shall be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before proposal due date. Submit complete design and performance data to the Architect. The Architect and Owner issue approvals of acceptable manufacturers as addenda to the Construction Proposal Documents.

B. Where acceptable manufacturers are listed, only products of those manufacturers may be provided. Additionally, the product must meet all the detailed requirements of the specifications.

C. If no manufacturer's name is mentioned, the Contractor shall provide equipment and material which meet the specifications.

1.13 UTILITIES, LOCATIONS AND ELEVATIONS

A. Locations and elevations of the various utilities included within the scope of this work:
   1. Obtained from utility maps and other substantially reliable sources.
   2. Are offered separate from the Contract Documents as a general guide only without guarantees to accuracy.

B. Examine the site and verify the location and elevation of all utilities and of their relation to the work. Existing utilities indicated on the site plans are for reference only and shall be field verified by the Contractor with the respective public or private utility.

1.14 CONTRACT DRAWINGS

A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

B. It is the responsibility of the Contractor to compare the scale of all electrical drawings with the scale of the architectural drawings and make adjustments to all electrical drawings which have the incorrect drawing scale so that his material takeoffs are not in error due to an incorrectly labeled drawing scale and his proposal is complete.

1.15 ABBREVIATIONS AND DEFINITIONS

A/V	Audio/Visual
AWG	American Wire Gauge
BCR	Building Communications Room
CATV	Cable Antenna Television

CCTV	Closed Circuit Television
CMP	Communications Media Plenum
CMR	Communications Media Riser
dB	Decibel
EMI	Electromagnetic Interference
ER	Equipment Room
FACP	Fire Alarm Control Panel
FCR	Floor Communications Room
Gbps	Giga Bits Per Second
Hz	Hertz
IC	Intermediate Cross-connect
IDF	Intermediate Distribution Frame
IM	Information Management
IS	Information Systems or Information Services (also see MIS)
IT	Information Technology
Km	Kilometer
LCD	Liquid Crystal Display
LED	Light Emitting Diode
M	Micron
MATV	Master Antenna Television *(A.K.A. Main Antenna Television)*
Mbps	Mega Bits Per Second
MC	Main Cross-connect
MDF	Main Distribution Frame
MHz	Megahertz
MIS	Management Information Systems or Services
NEXT	Near-End Cross Talk
nm	Nanometer
OFN	Optical Fiber Non-conductive
OFNP	Optical Fiber Non-conductive Plenum
OFNR	Optical Fiber Non-conductive Riser
OTDR	Optical Time Domain Reflectometer
PBX	Private Branch Exchange
POS	Point of Sale
PSELFEXT	Power Sum Equal Level Far-End Cross Talk
PSNEXT	Power Sum Near-End Cross Talk
SMATV	Satellite Main Antenna Television
TC	Telecommunications Closet *(Now referred to as TR)*
T.O.	Telecommunications Outlet
TR	Telecommunications Room *(A.K.A. TC - Telecommunication Closet)*
UTP	Unshielded Twisted Pair Wire

Definitions:

Administration Subsystem - Cable, connectors, cross-connect and inter-connect hardware, patch cords, and other equipment that allows easy reconfiguration of the telecommunications system to accommodate personnel and floor plans changes.

Campus Backbone Subsystem - Connects telecommunications processing equipment in different buildings on the same campus.

Communications Cabling - Any fiber optic, copper, coaxial or other transmission media used for transmitting or receiving communications systems data.

Communications System - Communications Systems and associated wired or wireless interconnection.

Communications Drawings - All floor plans, elevations, details, schematics, block diagrams, legends, tables, notes or attachments associated with any or all of the Communications Systems.

Distribution Cable - The telecommunications UTP wiring between the telecommunications room and the outlet connectors.

Equipment Subsystem - Telecommunications cable, connectors, support hardware, blocks, and protective devices that serve to connect the network interface and the backbone subsystem through the administrative subsystem.

Horizontal Subsystem - Telecommunications cable, outlets and distribution cords that extend the riser backbone from the administrative points in the TRs to workstations.

Information Systems - Software systems including operating systems, programs, data manipulation and management systems, control software and various forms of proprietary and off-the-shelf software.

Information Technology - The practical application of knowledge associated with designing, installing and maintaining the equipment, hardware and infrastructure utilized for control, distribution, or display of telecommunications, audio, video and data signals. Because computers are central to information management, computer departments within companies and universities are often called (IT Departments) and are responsible for MIS or IS personnel and services.

Low Voltage Wire - Wire or cable used for one or more systems that operate on 24 volts or less. Low Voltage Wire is used to install and interconnect one or more of the Communications Systems. Low Voltage Wire includes patch cords, jumpers and all portions of cable or wire used to make the Communications Systems operational or for system communications.

Management Information Systems - A class of software that provides managers with tools for organizing and evaluating their department. Typically, MIS systems are written in COBOL and run on mainframes or minicomputers. Within companies and large organizations, the department responsible for computer systems is sometime called the MIS department. Another name for MIS is Information Services (IS).

Multiplexer - A communications device that multiplexes (combines) several signals for transmission over a single medium. A multiplexer is sometimes called a "mux". A demultiplexer is required to complete the process by separating multiplexed signals from a transmission line. Frequently a multiplexer and demultiplexer are combined into a single device capable of processing both outgoing and incoming signals.

Riser Backbone Subsystem - Telecommunications cable, splice enclosures, and associated hardware that provide the main cable routes in a building. It interconnects building floors and larger areas of a single floor. It also interconnects administrative points in satellite TRs to the administrative points in the building main equipment room.

Station Cable - The wiring between the outlet connections and the work area equipment.

Communications Systems - One or more of the following and associated equipment: Data/Networking Systems, Telecommunications Systems, Paging / Intercom Systems, Clock/Control Systems, Master Antenna Television Systems, Cable Antenna Television Systems, Broadcast Video Systems, Audio/Visual Presentations Systems, Microwave/Wireless Systems.

Telecommunications - The transmission, emission or reception of signs, signals, images, sound or intelligence of any nature by wire, radio, optical or other technical transmission system.

Work Area - Location of an employee or student and their data/telecommunications equipment or devices.

Work Area Subsystem - Station mounting cords, extension cords, connectors, adapters, and interface units that provide physical and electrical connectivity between workstation equipment and the horizontal subsystem.

1.16 QUALITY ASSURANCE

A. Equipment Standards:
   1. System and all components shall be brand new stock from manufacturer.
   2. All electronics shall be 100% solid state.
   3. System and all components shall bear a UL Label.

B. Contractor Qualifications:
   At the time of Proposal, the Contractor shall:
   1. Have manufactured, supplied or installed at least three (3) other systems of similar size, complexity, and general operation as the systems described in these specifications. The Contractor shall furnish in writing to Architect proof of compliance with this paragraph at the time of proposal.
   2. Hold all legally required Texas State Contractor's licenses necessary to accomplish the installation and activation of the described system at the facilities indicated. The Contractor shall submit copies of licenses to the Architect prior to the start of work
   3. Hold all legally required state registrations to meet local requirements for submittal drawings.
   4. Have a local office within fifty (50) miles of the project site staffed with factory trained technicians who have experience on systems of similar complexity and function as the systems described in these specifications. These technicians shall be fully capable of system engineering support, installation supervising, system start-up, and providing the Owner with training and service on both hardware and software for the systems specified.
   5. Certify complete and total compliance with the provisions of these specifications by letter or submittal of the proposal response forms, signed by an officer of the corporation, or a principal if other ownership currently exists. In addition, the letter or forms shall include a complete listing of exceptions, if any.

1.17 SUBMITTALS

A. Provide SUBMITTALS according to Division 01 and the following.

B. Requirements:
   1. Submit paragraph-by-paragraph specification review indicating compliance or deviation with explanation.

2. Submit proof that all system components and cables are U.L. Listed.
3. An equipment list with names of manufacturers, model numbers, and technical information on all equipment proposed. Clearly mark exact model number proposed to be installed.
4. Product technical information sheets for each principal component in the proposed system, including cable, wire, terminal marking, and wire marking material.
5. Certification from the manufacturer stating that the system Contractor is an authorized distributor or installer of the proposed system when such certifications exist.
6. A statement listing every technical and operational parameter wherein the submitted equipment varies from that which was originally specified. If the submitter fails to list a particular variance and his submittal is accepted but is subsequently deemed to be unsatisfactory because of the unlisted variance, the submitter shall replace or modify such equipment at once and without cost to the Owner.

1.18 EXAMINATION OF SITE

A. The Contractor shall have visited the site and familiarized himself with all existing conditions prior to submitting his proposal and shall be prepared to carry out the work within the existing limitations. Failure or neglect to do so shall not relieve the Contractor of his responsibilities not entitle him to additional compensation for work overlooked and not included in his proposal.

B. The Contractor shall confirm the availability of the proper power source for each piece of specified equipment, through site visits and Drawings as necessary. Where proper power does not exist, the Contractor shall provide the required power, circuits, outlets, conduits, and wire as specified under Division 26.

1.19 DATA ACCURACY

A. Absolute accuracy of information regarding existing conditions cannot be guaranteed. The Drawings and Specifications are for the assistance and guidance of the Contractor and exact locations, distances, elevations, etc., shall be governed by actual field conditions. Where variations from the contract documents are required, such variations shall be approved by the Architect / Owner.

1.20 SECURITY

A. The Contractor is responsible for complying with all of the Owner's and facility security's requirements to prevent theft or damage to equipment, tools and materials. If any deviation from facility security requirements is necessary, approval for such deviation shall be coordinated with the Owner.

B. The Contractor shall not disclose any confidential information of the Owner. The Contractor acknowledges that such action is highly injurious and can do damage to the Owner. The Contractor will agree to and comply with the standard policies and provisions of the Owner regarding outside Contractors and Consultants.

1.21 UTILITIES

A. It shall be the responsibility of the Contractor to provide all temporary connection and cables, lighting, light stands and power. The facilities shall be used in accordance with all applicable regulations regarding operations, safety and fire hazards of the

governmental Authorities Having Jurisdiction, provided they are not used in a wasteful manner.

1.22 PERMITS

A. All permits required for the specified performance and completion of the work shall be secured by the Contractor. These permits shall be presented and reviewed at the initial project progress meeting.

1.23 NOTIFICATION

A. The Contractor shall not shut off any existing systems. The Contractor shall give the Owner at least ten (10) calendar day's notice of any requirements to shut off or interference with existing alarm, regulating, computer or other service systems. The Owner will arrange and execute any shutdown. All work such as splicing, connections, etc., necessary to establish or re-establish any system shall be completed by the Contractor in close coordination with the Owner.

1.24 INTERFERENCES WITH THE OWNER

A. Transportation and storage of materials at the facility, work involving the facility, and all other matters affecting the habitual use by the Owner of its buildings, shall be conducted so as to cause the least possible interference, and at times and in a manner acceptable to the Owner. The Contractor shall make every effort to delivery equipment per the schedule required by the project.

1.25 PROJECT RECORD DOCUMENTS

A. Maintain at the job site a separate set of white prints (blue line or black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is significantly at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various major and minor feeders, equipment, and other pertinent items, as installed. Record underground and under-slab cables installed, dimensioning exact location and elevation of such installations.

B. At conclusion of project, obtain without cost to the Owner, electronic AutoCAD 2014 or later / Revit CAD files of the original drawings and transfer as-built changes to these. Provide the following as-built documents including all contract drawings regardless of whether corrections were necessary and include in the transmittal: "2 sets of CDs and prints for Owner's use, one set of CDs, prints, and mylars for Architect / Engineers Records". Delivery of these as-built electronic, reproducible and prints is a condition of final acceptance.
   1. 3 sets of electronic AutoCAD (2014 dwg or later) / Revit CAD drawing files, on CD-ROM media, of each contract as-built drawing.
   2. One reproducible Dayrex mylar film positive of each contract as-built drawing.
   3. Three sets of blue or black-line prints of each contract as-built drawing.

C. As-Built Drawings should indicate the following information as a minimum:
   1. Indicate all addendum changes to documents.
   2. Remove Engineer's Seal, name, address, and logo from drawings.
   3. Mark documents AS-BUILT DRAWINGS.
   4. Clearly indicate: DOCUMENT PRODUCED BY:
   5. Indicate all changes to construction during construction. Indicate actual

routing of all conduit and cables, etc that were deviated from construction drawings.

6. Indicate exact location of all underground communications raceways, and elevations.
7. Correct schedules to reflect (actual) equipment furnished and manufacturer.
8. During the execution of work, maintain a complete set of Drawings and specifications upon which all locations of equipment, devices, and all deviations and changes from the construction documents in the work shall be recorded.
9. Exact location of all communications equipment in building. Label panel schedules to indicate actual location.
10. Exact location of all communications equipment in and outside of the building.
11. Location, size and routing of all communications cables, conduits, equipment, etc. shall be accurately and neatly shown to dimension.
12. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
13. Cloud all changes.

1.26 OPERATING TESTS

A. After all communications systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect / Engineer and Owner. Provide minimum 24-hour advance notice of scheduling of all tests. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.27 WARRANTY

A. All equipment shall be covered for the full manufacturers warranty period and systems shall be warranted by the Contractor for a period of two years commencing with the filing date of substantial completion. The Warranty shall cover all costs for warranty service, including parts, labor, prompt field service, pick-up, transportation, delivery, reinstallation, and retesting. A contract for service shall cover the period starting with the first expected activation of each system and shall continue without interruption to cover the period to the end of the two-year warranty as defined above. The end of the warranty period shall be handled such that a smooth transition to a maintenance agreement with the Owner shall be achieved with no lapse in coverage.

B. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.28 BUILDING CONSTRUCTION

A. It shall be the responsibility of the sub-contractor to consult the Architectural and Engineering drawings, details and specifications and thoroughly familiarize himself as to the construction and all job-related requirements. All construction trades shall cooperate with the General Contractor / Construction Manager job site superintendent and lay out work so that all piping, cables, pathways, raceways, and other items are placed in the walls, furred spaces, chases, etc., so that there shall be no delay in the job.

1.29 TEMPORARY FACILITIES

A. General: Refer to Division 01 for general requirements on temporary facilities.

B. Temporary Wiring: Temporary power and lighting for construction purposes shall be provided under Division 26. Installation of temporary power shall be in accordance with NEC Article 305.

C. Temporary facilities, wire, lights and devices are the property of this Contractor and shall be removed at the completion of the Contract.

1.30 EXTRA MATERIALS

A. Keys: Provide three (3) sets of all keys for system cabinets.

PART 2 - PRODUCTS

2.1 WORK INCLUDED

A. All materials listed in PART 2 - PRODUCTS of this Division Sections and on the Drawings shall be provided by the Contractor unless specifically excluded or modified in other portions of this Specification or Addendums.

2.2 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

A. Materials, in general, shall conform to the National Electrical Code requirements and shall be listed, inspected, and approved by the Underwriters Laboratories and shall bear the UL label where labeling service is available. The label or listing of the Underwriters Laboratories, Inc. will be accepted as evidence that the materials or equipment conform to the applicable standards of that agency. In lieu of this listing, the Contractor may submit a statement from a nationally recognized, adequately equipped testing agency, indicating that the items have been tested in accordance with required procedures, and that the materials and equipment comply with all Contract requirements.

2.3 STANDARD PRODUCTS

A. Materials and equipment shall be the standard catalog products of manufacturers regularly engaged in the manufacture of products conforming to these specifications and shall essentially duplicate materials and equipment that have been in satisfactory use at least two (2) years prior to bid opening. Where custom or special items are required, these shall be fully described using drawings, material lists, etc., which fully describe in detail the item proposed for use on this project.

2.4 MANUFACTURE'S INSTRUCTIONS

A. The Contractor is responsible for furnishing the proper Communication equipment and/or material and for seeing it is installed as intended by the manufacturer. The Contractor shall, wherever necessary, request advice and supervisory assistance from equipment manufacturers as required for the proper installation, operation, or start-up. The Contractor shall notify the Consultant, in writing, of any conflict between the Contract Documents and the manufacturer's recommendations and shall obtain, from the Consultant, instructions/direction before proceeding with the work. The Contractor shall pay for all costs resulting from deficiencies created by installation not in accordance with the manufacturer's recommendations or the instructions of the Consultant.

2.5 RUST PREVENTION

A. Metallic materials shall be protected against corrosion. Exposed metallic parts of equipment exposed to the elements shall be given a rust inhibiting treatment and standard finish by the manufacturer. Components such as boxes, bodies, fittings, guards, and miscellaneous parts shall be protected in accordance with the ASTM A123 or A153, except where other equivalent protective treatment is specifically approved in writing.

2.6 STORAGE AT SITE

A. The Contractor shall not receive material or equipment at the job site until ready for installation or until there is suitable space provided to properly protect equipment from rust, weather, humidity, dust, or physical damage.

B. All electronic equipment, containing sealed lead acid batteries or gel cells, shall be stored in climate-controlled area until installed or reinstalled. Do not store in non-climate controlled connex storage units.

C. Storage is to be provided and secured by the contractor. In the event that the Owner should agree to furnish storage space, security of the space and its contents shall remain the responsibility of the contractor.

2.7 CONDITION OF MATERIALS

A. All materials required for the installation of the Communication systems shall be new and unused. Any material or equipment damaged in transit from the factory, during delivery to premises, while in storage on premises, while being installed, or while being tested, until time of final acceptance, shall be replaced by this Contractor without extra cost to Owner.

2.8 NAMEPLATES

A. Factory assembled components and equipment shall be provided with be factory stamped labeling. Labeling will have information required to specifically identify the component and/or equipment in the future such as the manufacturer's name, catalog number, serial number, etc. All data on the labels shall be legible at the time of final inspection.

2.9 ACCESS DOORS

A. Wherever access is required in walls or ceilings to concealed junction boxes, pull boxes, equipment, etc., installed under this Division, furnish a hinged access door and frame with flush latch handle to another Division for installation. Doors shall be as follows:
   1. Plaster Surfaces: Milcor Style K.
   2. Ceramic Tile Surfaces: Milcor Style M.
   3. Drywall Surfaces: Milcor Style DW.
   4. Install panels only in locations approved by the Architect.

2.10 SPACE LIMITATIONS

A. Equipment shall be chosen which shall properly fit into the physical space provided and shown on the drawings, allowing ample room for access, servicing, removal and

replacement of parts, etc. Adequate space shall be allowed for clearances in accordance with applicable codes and standards. Physical dimensions and arrangement of equipment shall be subject to the approval of the Consultant.

PART 3 - EXECUTION

3.1 INSTALLATION

A. This project has a critical path, which must be closely followed in order to meet the completion date. The Contractor shall review the proposed schedule at the Award of Contract meeting and be prepared to staff his work force according to the schedule constraints presented at that time.

B. Aesthetics are an important consideration in this installation. All components shall be installed so as to have aesthetically pleasing results as determined by the Owner and Architect. Actual locations of all visible components shall be coordinated in advance with the Owner and Architect.

C. Install, make fully operational and test the system as indicated on the Drawings and in the Specifications. Where information is not available the worst-case condition must be assumed to ensure a complete, functional system.

D. Any interfacing with other systems shall be the Contractor's responsibility under this contract, and the details, both logical and physical, of such interfaces shall be reflected in the Submittals and As-Built drawings.

E. If appropriate, interfaces with the Owner's Data Network, Telecommunications and Communications System shall be coordinated with the Owner and Architect.

F. All necessary back boards, back-boxes, pull-boxes, connectors, supports, conduit, cable and wire shall be furnished and installed to provide a complete and reliable system. Exact location of all backboards, boxes, conduit and wiring runs shall be presented to the Owner / Architect for approval in advance of any installation. Provide as required and as specified in Division 26.

G. Where required provide 120-VAC, 60 Hz power from nearest electrical panel through a junction box, to the system devices. Provide as required and as specified in Division 26.

H. Where required, install conduit, cable and wire parallel and square with building lines, including raised floor areas. Conduit fills shall not exceed 40%.

I. Ground busses shall be provided in each any room with communication equipment.

J. All equipment shall be mounted with sufficient clearance to minimize EMI as well as meet all applicable codes and facilitate observation and testing. Securely hand and/or fasten with appropriate fittings to ensure positive grounding, free of ground loops, throughout the entire system. Units shall be installed parallel and square to building lines.

K. Communications grounding system shall be a single point grounding from the building entrance electrical ground to each Communications room.

L. All Conduit systems, cabinets' racks, cable trays, protector blocks, SCTP patch panels and/or miscellaneous equipment, etc. shall be grounded by being connected to the

common communications grounding system. The conductors shall be a # 6awg solid with a green jacket

M. Quiet and vibration-free operation of all equipment is a requirement of this installation. Properly adjust, repair, balance or replace any equipment producing objectionable (in the judgment of the Owner or Architect) noise or vibration in any of the occupied areas of any building and provide additional brackets and bracing if necessary. Any such additions or changes shall be at no additional cost to the Owner.

N. Installation shall comply with the CODES AND STANDARDS portion of this Section. Where more than one code or regulation if applicable, the more stringent shall apply.

O. Where new equipment is replacing old equipment, the Contractor is responsible for removing and disposing of the old equipment and doing whatever repair work is necessary as specified by the Owner / Architect.

P. Install firestopping, as specified in Division 26 for all penetrations in slabs and firewalls to meet code at the completion of work and prior to final testing demonstration to the Owner.

Q. The installation shall be performed in a professional manner.

R. On a daily basis, clean up and deposit in appropriate containers all debris from work performed under the appropriate specification sections. Stack and organize all parts, tools and equipment when not being used.

S. Preparation, handling and installation shall be in accordance with the Manufacturer's written instructions and technical data appropriate to the product specified.

T. All work shall conform to the National Electrical Contractor's Association "Standard of Installation" for general installation practice.

U. At the conclusion of the installation, all work areas, including all enclosures and boxes, shall be vacuumed and cleaned to remove all debris and grease.

3.2 COORDINATION WITH OWNER / ARCHITECT

A. Close coordination with the Owner / Architect is vital to achieve a complete, aesthetically pleasing job. The Contractor shall ensure that the Owner / Architect is kept fully apprized of job progress.

3.3 CUTTING, PAINTING, AND PATCHING

A. Structural members shall not be drilled, bored or notched in such a manner that shall impair their structural value. Cutting of holes in structural members, if required, shall be done with core drills and only with the specific approval of the Owner / Architect for each instance.

B. All walls that require cutting or repair during the installation process shall be returned to their original condition, including the matching of colors and finishes to the satisfaction of the Owner / Architect, and at no additional cost to the Owner.

3.4 WIRE AND CABLE

A. All low voltage cable shall be low smoke plenum rated, limited energy, with 300-volt

insulation.

B. All wires in exposed areas shall run through conduit as specified in Division 26.

C. Provide conduits, cable trays, raceways, wireways, boxes and outlets as specified in Division 26.

D. After installation, and before termination, all wiring shall be checked and tested to insure there are no grounds, opens, or shorts on any conductors. In addition, all wires between buildings or underground and all coax cables shall have insulation tested with a megohmmeter (megger) and a reading of greater than 20 megohms shall be required to successfully complete the test.

E. Run wires continuously from termination to termination without splices.

F. Wire and cable shall be supported in each equipment and terminal cabinet and in each terminal and pull box in vertical risers and horizontal runs with wire duct and strap-type supports. At any point where wire duct is required for good wire management, whether shown on elevations or not, install appropriate duct. Where terminal boards are used, wire ducts shall be supplied on both sides and at not rime shall wires cross over terminal boards. Arrange cables neatly to allow inspection, removal and replacement. Lace cables as required. Spot tie wire bundles with plastic cable ties and securely affix to panels. If screw type terminals are specified, terminal strip connections shall be locking, tongue style, pressure crimp, and solderless spade lug.

G. Visually inspect wire and cable for faulty insulation prior to installation. Protect cable ends at all times with acceptable end caps except during actual termination. At no time shall any coaxial cable be subjected to a bend less than a 6-inch radius. Protect wire and cable from kinks. Install 1 pull rope for all 2” or larger sized conduits.

H. Provide plastic bushings and strain relief material at all conduit exit points and where necessary, to avoid abrasion of wire and excess tension on wire and cable.

I. Cables above accessible ceilings shall not rest on ceiling tiles. Use Velcro tie wraps, J-hooks or D-rings to hold cables. Provide independent support for all cables. Support is to be from building structure (do not support from pipes or conduits). Communications cables shall not tie off on HVAC supports, all-thread, ceiling grid hanger wire or electrical / mechanical piping system.

J. Ground and bond equipment and circuits in accordance with NEC and Division 26.

3.5 IDENTIFICATION AND TAGGING

A. All cables, wires, wiring forms, terminal blocks and terminals shall be identified by labels, tags to other permanent markings in accordance with TIA/EIA-606. The markings shall clearly indicate the function, source, or destination of all cabling, wiring and terminals. All cables and wires shall be identified, utilizing heat-shrink, machine printed, polyolefin wire markers (Brady Type B-32 *or equal*). Handwritten tags are not acceptable.

B. Should a situation arise where the wire tagging format as shown on the drawings cannot be used, a substitute format shall be submitted which complies with the intent to provide documentation that will permit end-to-end tracing of all Communications Systems wiring.

C. All panels shall be provided with permanently attached engraved lamacoid labels with identifying names and functions. All terminal points shall be appropriately labeled. Labels shall be consistent in form, color, and typeface throughout the system and all must contain the name of the system or subsystem as part of the label textual information. Design, color, font and layout shall be coordinated with, and approved by, the Owner.

D. Identification of Equipment:
   1. All major equipment shall have a manufacturer's label identifying the manufacturer's address, equipment model and serial numbers, equipment size, and other pertinent data. Take care not to obliterate this nameplate. The legend on all nameplates or tags shall correspond to the identification shown on the Operating Instructions.
   2. A black-white-black 3 layer laminated plastic engraved identifying nameplate shall be permanently secured to each wireway, terminal cabinet, and communications (voice, data, video) cabinet or rack.
      a. Identifying nameplates shall have 1/2-inch high, engraved letters. For equipment designation and ¼-inch letters indicating source circuit designation, (i.e.: “IDF(FCR) XXYY –served from MDF (BCR) XXGG).
   3. Permanent, waterproof, black markers shall be used to identify each communications grid junction box, clearly indicating the type of system available at that junction box.
   4. Pull Boxes: Field work each with a nameplate showing identity, and identifying equipment connected to it. Nameplates shall also indicate where pull box is fed from.
   5. Communication hardware located above accessible ceilings: Provide ½-inch high black name plate with white 1/4-inch letters glued to bottom of t-grid ceiling below hardware located above ceiling. Identification shall be as short as possible yet identifying device above ceiling, i.e. “A/V-EQ”.

E. Prohibited Markings: Markings intended to identify the manufacturer, vendor, or other source from whom the material has been obtained are prohibited for installation in public, tenant, or common areas within the project. Also prohibited are materials or devices that bear evidence that markings or insignias have been removed. Certification, testing (example, Underwriters Laboratories), and approval labels are exceptions to this requirement.

F. Warning Signs: Provide warning signs where there is hazardous exposure associated with access to or operation of communications facilities. Provide text of sufficient size to convey adequate information at each location; mount permanently in an appropriate and effective location. Comply with industry standards for color and design.

G. Wire and Cable Labeling: Provide wire markers on each conductor in all boxes, pull boxes, gutters, wireways. Identify with drop/circuit number.

H. Underground Warning Tape: Thomas and Betts or approved equal. Six-inch wide plastic tape, colored red or orange with suitable warning legend describing buried communications lines. All underground conduits shall be so identified. Tape shall be buried at a depth of 6-inches below grade and directly above conduits or ductbanks. Provide magnetic marking tape below all underground conduits.

3.6 CUTTING AND PATCHING

A. General: Comply with the requirements of Division 01 for the cutting and patching of

other work to accommodate the installation of electrical work. Except as authorized by the Architect / Engineer, cutting and patching of electrical work to accommodate the installation of other work is not permitted.

3.7 INSTRUCTION OF OWNER'S PERSONNEL

A. Before proceeding with the instruction of Owner Personnel, prepare a typed outline in triplicate, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he has a proper understanding of the operation and maintenance of the systems and resubmit the signed outlines.

B. Prior to substantial completion, conduct an on-site training program to instruct Owner's operating personnel in the operation and maintenance of the communications systems.
   1. Provide the training during regular working day.
   2. The Instructors shall be experienced in their phase of operation and maintenance of the systems and with the project.

C. Time to be allocated for instructions.
   The Contractor shall furnish the services of factory trained specialists to instruct the Owner's operating personnel. The Owner's operator training shall include training as specified per system specification,
   1. Minimum of four (4) hours dedicated instructor time
   2. 2-hour sessions on different, non-consecutive days
   3. Additional instruction time for specific systems as specified in other Sections.

D. Before on-site training, submit the program syllabus; proposed time and dates; for review and approval, minimum 48 hours prior to proposed training time and date.
   1. One copy to the Owner
   2. One copy to the Architect / Engineer

E. The Owner shall provide a list of personnel to receive instructions and shall coordinate their attendance at the agreed upon times.

F. Use operation and maintenance manuals as the basis of instruction. Review manual with personnel in detail. Explain all aspects of operation and maintenance.

G. Demonstrate start-up, operation, control, adjustment, troubleshooting, servicing, maintenance, and shut down of each item of equipment.

H. Demonstrate equipment functions (both individually and as part of the total integrated system).

I. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.

J. Submit a report within one week after completion of training. List time and date of each demonstration, hours devoted to the demonstration, and a list of people present, with their respective signatures.

K. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he/she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed,

and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.

L. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

3.8 OPENINGS

A. Framed, cast or masonry openings for boxes, equipment or conduits are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.9 OBSTRUCTIONS

A. The drawings indicate certain information pertaining to surface and subsurface obstructions, which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
   1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
   2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.

B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.10 VANDAL RESISTANT DEVICES

A. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner 2 suitable tools for use with each type of fastener used.

B. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.11 PROTECTION

A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

B. Do not deliver equipment to this project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather shall be rejected, and the contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.

3.12 EQUIPMENT BACKBOARDS

A. Backboards: ¾ inch, fire retardant, exterior grade plywood, painted gray, both sides.
   1. Provide minimum of two 4-ft. by 8-ft. sheets of plywood for each location shown.
   2. Provide minimum of two 4-ft. by 4-ft. sheets of plywood for each communications location.

3.13 SITE MANAGEMENT RESPONSIBILITY

A. The Contractor shall provide an on-site Project Manager as defined in CONTRACTOR'S QUALIFICATIONS portion of this Section.

3.14 DEMOLITION AND RELOCATION

A. The Contractor shall modify, remove, and relocate all materials and items so indicated on the drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain as directed by the Owner. Materials and items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to the approval of the Owner. The Contractor may substitute new materials and items of like design and quality in lieu of materials and items to be relocated, if approved by the Owner.

B. All items scheduled for relocation and/or reuse shall be inspected by the Contractor and the Owner or his authorized representative. A written report of the condition of each item shall be made and provided to the Consultant. Where items scheduled for relocation and/or reuse are considered unsuitable for reuse, the Contractor shall so notify the Consultant and await reinstallation instructions before proceeding with removal. Items damaged in reinstallation shall be repaired or replaced by the Contractor as directed by the Owner at no additional cost to the Owner or the Consultant.

C. All items which are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean, repair, and provide all new materials, fittings, and appurtenances required to complete the relocation and to restore the items to good operative order. All relocations shall be performed by workmen skilled in the work ad in accordance with standard practice of the trades involved.

D. Service lines and wiring to items to be removed, salvaged, or relocated shall be removed to points as indicated on the drawings, specified, or acceptable to the Owner. Service lines and wiring not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied off or connections into the existing facilities in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities which must remain in operation during the construction period shall not be interrupted without prior specific written approval of the Consultant.

3.15 EXISTING SYSTEM TESTING

A. Contractor shall have each low voltage system tested prior to the commencement of construction. Systems shall include all systems that fall under the Division 27 umbrellas, as identified in the Division 27 of the Construction Specifications Institute (CSI) current Master Format . Test shall include the functionality of all field devices and equipment. Any failures or items found to be functioning not to specification, shall be reported prior to construction. Any items found to be improperly or non-functioning upon the completion of the project, shall be replaced and/or repaired, by the contractor, at no additional cost to the project or the owner.

B. Contractor shall document the location and any ID tag, MAC address, IP address, or

bar code of any existing device that is to be removed from its current location. Devices that are to remain, shall be reinstalled in the exact location that they reside in prior to construction, unless noted otherwise.

C. Any individual/firm that will be removing, relocating, reinstalling, or tampering with any devices; shall be licensed by the state and certified by the manufacturer of the system.

D. Contractor shall remove any devices where construction occurs to prevent possible damage to the device. Removal of any devices which support user connection or other systems, shall be coordinated with the owner prior to removal and/or taking offline.

3.16 START-UP RESPONSIBILITY

A. The Contractor shall initiate System operation. The Contractor shall provide competent Start-Up personnel on each consecutive working day until all Communications Systems are functional and ready to start the acceptance test phase. If the Contractor, in the Owner / Architect's judgment, is not demonstrating progress in solving any technical problems, the Contractor shall supply Manufacturer's factory technical representation and diagnostic equipment at no cost to the Owner, until resolution of those defined problems. Where appropriate, the Contractor shall bring the Systems on-line in their basic state (i.e., alarm reporting, facility code access control, etc.) It is the responsibility of the Owner to provide the specific database information that will be utilized for initial system programming.

B. Properly ground each piece of electronic equipment prior to applying power. Properly ground all shielded wire shields to the appropriate earth ground at the hub end only, not at the remote or device end.

C. Use a start-up sequence that incrementally brings each portion of the system on-line in a logical order that incorporates checking individual elements before proceeding to subsequent elements until the entire system is operational. The basic steps should include:
   1. Establish ground planes at the equipment rooms and hub end of the systems as specified in Division 26.
   2. Disconnect power, connect the first device, reconnect power, and verify operational correctness. Repeat until the entire system is verified and operational.

3.17 PREPARATION FOR ACCEPTANCE (SUBSTANTIAL COMPLETION)

A. All systems, equipment, and devices shall be in full and proper adjustment and operation, and properly labeled and identified.

B. All materials shall be neat, clean and unmarred, and parts securely attached.

C. All extra material as specified shall be delivered and stored at the premises as directed.

D. Test reports of each system and each system's components and As-Built Project Drawings shall be complete and available for inspection and delivery as directed by the Owner.

3.18 SYSTEM ACCEPTANCE REQUIREMENTS

A. Before final acceptance or work, the Contractor shall perform and/or deliver each of the following in the order stated.

B. The Contractor shall deliver three (3) composite “System Operations and Maintenance” manuals in three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain in appropriately tabbed sections:
   1. A statement of Guarantee including date of termination and the name and phone number of the persons to be called in the event of equipment failure.
   2. A set of Operating procedures for the overall System that includes all required Owner activities, and that allows for the Owner operation of all attributes and facilities of the System.
   3. A section for each specific type of equipment containing the vendor manuals, instruction sheets, and any related literature that cam in the original shipping container for that piece of equipment. Include all warranty cards.

C. Testing:
   1. The Contractor shall perform all tests required by Division 26 and those submitted as part of this Section.
   2. The Contractor shall activate all devices for proper system operation, including supervisory and trouble circuit tests. Similarly, audible alarms will not be activated except on a one-time, coordinated basis, to check the actual sounding devices.
   3. A test report for each piece of equipment shall be prepared by the Contractor and submitted to the Owner. This report shall include a complete listing of every device, the date it was tested, by whom and the results. The final test reports shall indicate that every device tested successfully. Failure to completely test and document the tests will result in a delay of final testing and acceptance.

D. As-Built Drawings:
   1. After completion of all the tests listed above, and prior to the final acceptance test, The Contractor shall submit the complete As-Built drawings as identified in PART 1 – PROJECT RECORD DRAWINGS.
   2. The final As-Built Drawings shall consist on one set of reproducible prints, two (2) sets of Point-to-Point Detail Drawings, Equipment Schedules, and the complete detailed technical data that was shipped by the manufacturer with all installed equipment.

E. Final Acceptance Test: The Final Acceptance Test shall demonstrate the installed and activated System’s performance and compliance with System Specifications. However, before this testing can begin the following must have received and reviewed by the Owner.
   1. System Operations and Maintenance Manuals
   2. System Test Reports
   3. As-Built Drawings

3.19 FINAL ACCEPTANCE

A. The date of final acceptance shall be the date of owner occupancy, or the date all punch list items have been completed or final payment has been received. Refer to Division 1 for additional requirements

B. When the Final System Acceptance Requirements described above including the Final Acceptance Test described above have been satisfactorily completed. The

Owner / Architect shall issue a Letter of Completion to the Contractor indicating the date of such completion. The Notice of Completion shall be recorded by the Contractor upon receipt of the Owner / Architect completion letter. This date of record shall be the start of the warranty period.

END OF SECTION

SECTION 27 05 07

COMMUNICATIONS SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Prepare submittals as required by Division 01 and as outlined below.

B. Submit product data shop drawings only for the following and for items specifically requested elsewhere in the Contract Drawings and Specifications. Architect / Engineer reserves the right to refuse shop drawings not requested for review and to imply that materials shall be provided as specified without exception.

C. The term submittal, as used herein, refers to all:
1. Shop Drawings
2. Coordination Drawings
3. Product data

D. Submittals shall be prepared and produced for:
1. Distribution as specified
2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.

B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.

C. Identify field dimensions; show relation to adjacent or critical features or work or products.

1.3 COORDINATION DRAWINGS

A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: 1/4"=1'-0".

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 technology equipment and each rack with technology equipment, submit plan and elevation drawings. Show:
1. Actual technology equipment and components to be furnished.
2. NEC working space and NEC access to NEC working space.
3. Relationship to other equipment and components and openings, doors and obstructions
4. Rack location and dimensions

D. Identify field dimensions. Show relation to adjacent or critical features of work or

products.

E. Verify location of communications station devices, telephone outlets and other work specified in this Division.
   1. Coordinate with drawing details, site conditions and millwork shop drawings prior to installation.
   2. Where required for clarification, submit shop drawings prior to rough-in and fabrication.

F. Submit shop drawings in plan, elevation and sections, showing outlets and other devices in casework, cabinetwork and built-in furniture.

1.4 PRODUCT DATA

A. All product options specified shall be indicated on the product data submittal. All options listed on the standard product printed data not clearly identified as not part of the product data submitted shall become part of the Contract and shall be provided.

B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.

C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.

D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.

E. Mark up a copy of the specifications for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect / Engineer / Owner (Does Not Comply, Explanation:)

1.5 MANUFACTURERS INSTRUCTIONS

A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up and adjusting.

1.6 CONTRACTOR RESPONSIBILITIES

A. Review submittals prior to transmittal.

B. Determine and verify:
   1. Field measurements
   2. Field construction criteria
   3. Manufacturer's catalog numbers
   4. Conformance with requirements of Contract Documents

C. Coordinate submittals with requirements of the work and of the Contract Documents.

D. Notify the Architect / Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.

E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect / Engineer's acceptance.

F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect / Engineer reviews submittals or not.

G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect / Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations on reviewed documents.

H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
   1. Proper sizes and capacities
   2. That the item will fit in the available space in a manner that will allow proper service
   3. Construction methods, materials and finishes

I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

1.7 SUBMISSION REQUIREMENTS

A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.

B. Number of submittals required:
   1. Shop Drawings and Coordination Drawings: Submit four opaque reproductions.
   2. Product Data: Submit the number of copies the contractor requires, plus those to be retained by the Architect / Engineer.

C. Accompany submittals with transmittal letter, in duplicate, containing:
   1. Date
   2. Project title and number
   3. Contractor's name, address and telephone number
   4. The number of each Shop Drawing, Project Datum and Sample submitted
   5. Other pertinent data

D. Submittals shall include:
   1. The date of submission
   2. The project title and number
   3. Contract Identification
   4. The names of:
      a. Contractor
      b. Subcontractor
      c. Supplier
      d. Manufacturer
   5. Identification of the product
   6. Field dimensions, clearly identified as such
   7. Relation to adjacent or critical features of the work or materials
   8. Applicable standards, such as ASTM or federal specifications numbers

9. Identification of deviations from contract documents
10. Suitable blank space for General Contractor and Architect / Engineer stamps
11. Contractor's signed and dated Stamp of Approval

E. Coordinate submittals into logical groupings to facilitate interrelation of the several items.
1. Finishes which involve Architect / Engineer selection of colors, textures or patterns
2. Associated items requiring correlation for efficient function or for installation

1.8 SUBMITTAL SPECIFICATION INFORMATION

A. Every submittal document shall bear the following information as used in the project manual:
1. The related specification section number
2. The exact specification section title

B. Submittals delivered to the Architect / Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.9 RESUBMISSION REQUIREMENTS

A. Make resubmittals under procedures specified for initial submittals.
1. Indicate that the document or sample is a resubmittal
2. Identify changes made since previous submittals

B. Indicate any changes which have been made other than those requested by the Architect / Engineer.

1.10 CONTRACTOR'S STAMP OF APPROVAL

A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.

B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect / Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.

C. Do not deliver any submittals to the Architect / Engineer that do not bear the Contractor's stamp of approval and signature.

D. Submittals delivered to the Architect / Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.11 ARCHITECT / ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

A. The Architect / Engineer will:
1. Review identified submittals with reasonable promptness and in accordance with schedule. Specific equipment submittals that may be required to be

expedited shall be submitted separately without other submittal items not requiring the same prompt attention.
2. Affix stamp and initials or signature, and indicate requirements for resubmittal or approval of submittal
3. Return submittals to Contractor for distribution or for resubmission

B. Review of submittals will not extend to design data reflected in submittals that is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.

C. Architect / Engineer's review is only for conformance with the design concept of the project and for compliance with the information given in the contract.
1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.

D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

1.12 SUBSTITUTIONS

A. Do not make requests for substitution employing the procedures of this Section.

B. The procedure for making a formal request for substitution is specified in Division 1.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 SHOP DRAWINGS AND PRODUCT DATA

A. Submittals shall not be combined or bound together with any other material submittal.

B. Submit individually bound shop drawings and product data for the following when specified or provided:
1. Structural Cabling
2. Communications System
3. Sound Reinforcement System
4. CATV System

3.2 COORDINATION DRAWINGS

A. Submit coordination drawings as specified.

END OF SECTION

SECTION 27 05 09

CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Contract quality control including workmanship, manufacturer's instructions, mock-ups and demonstrations.

1.2 QUALITY CONTROL PROGRAM

A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents.

1.3 WORKMANSHIP

A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.

B. Perform work by persons qualified to produce workmanship of specified quality.

C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.

D. Provide finishes to match approved samples; all exposed finishes shall be approved by the Architect / Engineer. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

A. Comply with instructions in full detail, including each step in sequence.

B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

A. When required in individual Specification Sections, manufacturer shall provide a manufacturer’s qualified personnel to observe:
   1. Field conditions.
   2. Condition of installation.
   3. Quality of workmanship.
   4. Start-up of equipment.
   5. Testing and adjusting of equipment.

B. Manufacturer’s qualified personnel shall make written report of observations and recommendations to Architect/Engineer.

1.7 MOCK UPS

A. Assemble and erect the specified equipment and products complete, with specified anchorage and support devices, seals and finishes.

B. Do not proceed with any work involving a mock-up, until the related mock up has been approved in writing.

C. Acceptable mock-ups in place shall be retained in the completed work where possible.

D. Perform tests and submit results as specified.

1.8 SCHEDULING OF MOCK-UPS

A. Schedule demonstration and observation of mock-ups, in phases, with Architect / Engineer.
   1. Rough-in
   2. Finish with all appurtenances in place
   3. Demonstrations

PART 2 - PRODUCTS

2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS.

PART 3 - EXECUTION

3.1 ADJUSTMENTS AND MODIFICATIONS

A. Contractor shall provide all adjustments and modifications as requested by the manufacturer’s qualified personnel at no additional cost to Owner.

3.2 MOCK-UPS

A. Mock-up a typical classroom, science lab of each type, and computer lab with all wiring devices, cover plates, rough-in boxes, conduits, etc. Provide all conductors from all wiring devices to above ceiling space to demonstrate conduit routing and conductor fill.

END OF SECTION

SECTION 27 05 10

FIRESTOPS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide firestop as required, and as specified. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.

B. Types: Firestop required for the project includes smoke stop.

1.2 QUALITY ASSURANCE

A. UL Label: Firestops shall be UL labeled.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Nelson.

B. 3M (Minnesota Mining Manufacturing).

C. Hilti

D. Specified Technologies, Inc.

2.2 MATERIAL AND COMPONENTS

A. General: Except as otherwise indicated, provide firestop manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended by the manufacturer, and as required for installation.

2.3 FIRESTOP

A. Conduits: Provide a soft, permanently flexible sealant for 1-1/2 to 2 hour rated fireproofing for steel conduits (up to 4" diameter).

B. Low Voltage Cables, Fiber Optic Cable and Innerduct: Provide Specified Technologies, Inc. EZ-Path single, double, or triple pathways as required.

PART 3 - EXECUTION

3.1 INSTALLATION OF FIRESTOPS

A. General: Install firestops in accordance with the manufacturer's installation instructions and industry practices to ensure that the firestops comply with requirements. Comply with UL and NFPA standards for the installation of firestops.

END OF SECTION

SECTION 27 10 00

STRUCTURED CABLING SYSTEM (SCS)

PART 1 - GENERAL

1.1 RELATED WORK

The following, in their entirety and as applicable, shall apply to this section. Including any associated drawings.

A. Conditions of the Contract
B. Division 1
C. Division 26
D. Division 27
E. Division 28

1.2 DESCRIPTION

A. Summary of Work:
   1. Reference Attachment ‘A’ of this specification for supplemental scope as it relates to the project and the Owner standards.
   2. Provide a complete and tested Structured Cabling System (SCS) for the interconnections of the Local Area Network (LAN). The SCS shall include fully terminated unshielded twisted pair cables, fiber optic cabling, raceways, conduit, back boxes, copper/fiber optic termination components, station mounting hardware, fiber optic enclosures, patch panels, copper/fiber optic patch cables, relay cabinets/cabinets, and other incidental and miscellaneous premises wiring system hardware as required for a complete, tested, and usable system that is in compliance with the latest NEC, ANSI/EIA/TIA, BICSI, and Authorities Having Jurisdiction codes and standards. The installation shall comply with all applicable requirements, design guidelines, and standards in effect at the job site and as indicated in the Drawings and Specifications.
   3. An IDF will be required when the distance between outlet terminations and MDF/IDF exceeds 280’, including service loops. IDF's shall be selected and organized to be minimum in number while still reaching all locations to be wired.
   4. If there are any discrepancies between the drawings and specification or among themselves, the contractor shall request clarification prior to providing pricing for the scope of work. If a request is not issued and a response not provided via a posted addendum, the contractor shall provide pricing for the costliest scenario and obtain clarification during the project.
   5. These documents are conceptual in nature. It shall be the responsibility of the approved installer to furnish a complete and functional system, including the items shown on the drawings, in the specifications, and items not designated in either. The installer’s shop drawings and product data submittals shall represent a complete system and documents accepted do not relieve the installer from being required to provide any materials, equipment, or labor to furnish a complete and functional system as recognized by the Project’s Technology Consultant and the Owner.

1.3 QUALITY ASSURANCE

A. Acceptable manufacturers:
   1. The equipment/products described herein and furnished per these specifications shall be the product of one manufacturer or must be able to obtain the full warranty of the combined solution. All references to model numbers and other detailed descriptive data is intended to establish standards

of design performance, and quality, as required. The contractor shall not deviate from the part numbers listed. Any deviation from specified part numbers will result in the removal of non-specified materials and reinstallation of approved materials at no cost to the project.

2. The approved manufacturers shall provide a complete End-to-End solution with the maximum product and performance warranty offered by the specified manufacturer.
3. Only products listed in Attachment 'B' or approved in compliance with the project manual's approval requirements will be accepted.

B. Installer Qualifications:
1. The Data Cable System Installer shall be licensed and shall meet all applicable regulations of the State Department of Labor insofar as they apply to this type of system. The proposer shall be a firm normally employed in the low voltage and data cabling industry and shall provide a reference list of ten (10) large-scale projects and contact names confirming successful Structure Cabling System installations.
2. The SCS Installer shall be a Certified, local area, integrator of the manufacturer's product and must be able to provide the manufacturer's maximum available warranty for the solution on the entire SCS. The contractor's certification must have been obtained and held within 75 miles of the project's location.
3. The installing contractor must have a full-time employed RCDD (Registered Communications Distribution Designer) on staff. Current RCDD certification shall be provided in the product submittals.
4. All individuals installing the SCS must be employees of the certified installer and at least 25% of the installing staff shall have undergone a training class given by the manufacturer. Current certification indicating the successful completion of the training course shall be available upon request at the project and submitted in the contractor's product submittals.
5. The proposing contractor and the installing contractor must be the same company. No subcontractor to the proposing SCS contractor will be allowed for any portion of the SCS scope of work.

C. Low Voltage Meeting Requirements:
1. The successful Contractor shall attend a mandatory pre-construction meeting with the project's consultant individuals deemed necessary by the Owner's representative prior to the start of the work. No SCS work shall begin prior to this meeting.
2. The successful contractor shall attend a mandatory bi-weekly meeting to discuss the project progress to help aid coordination with the Owner and Other contractors.
3. Prior to the installation of any items required for this scope of work the contractor must provide a purchase order with a detailed material list for all materials to be installed. The purchase order is not required to show cost, but part numbers must be provided. The purchase order will be reviewed during one of the regularly scheduled low voltage meetings.

D. Acceptance: The Owner's representative reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.

E. Warranty:
1. The selected system installer shall be a certified installing contractor of product and hold current certification. Contractor shall provide the specified manufacturer's maximum end-to-end performance warranty on all products installed. The proposer shall provide current certification documentation. The

performance warranty shall be issued by the manufacturer and shall warrant that ALL cable links have been tested bi-directionally (end to end) using a Level IIIe or better tester, per TSB-67, and that all test results conform to the most current ANSI/TIA-568.2-D.

2. The warranty will also cover multimode fiber optic cabling. Performance testing shall be conducted in accordance with ANSI/EIA/TIA-526-14 Standard, method B.
3. The warranty will stipulate that all products used in this installation meet the prescribed mechanical and transmission specifications for such products as described in ANSI/TIA/EIA-568.3-D. Quality and workmanship evaluation shall be solely by the Owner/Designer and designated representatives.

1.4 REGULATORY REQUIREMENTS

A. Standards: All work shall be performed in accordance with the latest revisions of the following standards and codes:
   1. Latest Local Codes and Amendments
   2. National Electrical Code, current version

B. Other References:
   1. ANSI/TIA-568-C.0 – Generic Communications Cabling for Customer Premises...
   2. ANSI/TIA-568-C.1 – Commercial Building Communications Cabling Standard Part 1: General Requirements.
   3. ANSI/TIA 568-C.2 – Balanced Twisted-Pair Telecommunications Cabling and Components Standards
   4. ANSI/TIA 568-C.3 – Optical Fiber Cabling Components Standard
   5. ANSI/TIA-568-C.4, Coaxial Cabling Component Standard
   6. ANSI/TIA-569-C – Commercial Building Standard for Telecommunications Pathways and Spaces.
   7. ANSI/TIA-492.AAAC-B – Detail Specification for 850-nm Laser-Optimized, 50-um Core Diameter/125-um Cladding Diameter Class 1a Graded-index Multimode Optical Fibers (OM3/OM4). Current Edition
   8. ANSI/ICEA S-83-596, Fiber Optic Premises Distribution Cable.
   9. ANSI/TIA/EIA-598, Color Coding of Optical Fiber Cables
   10. ANSI/ICEA S-87-640, Fiber Optic Outside Plant Distribution Cable.
   11. ANSI/TIA/EIA-758: Customer-Owned Outside Plant Telecommunications Cabling Standard.
   12. ANSI/TIA/EIA-526-7, Optical Power Loss Measurements of Installed Single mode Fiber Plant: OFSTP-7.
   13. ANSI/TIA/EIA-526-14-A, Optical Power Loss Measurements of Installed Multimode Fiber Plant: OFSTP-14A
   14. ANSI/TIA/EIA-TSB-125, Guidelines for Maintaining Optical Fiber Polarity Through Reverse-Pair Positioning
   15. ANSI/TIA/EIA-TSB-140, Additional Guidelines for Field Testing Length, Loss, and Polarity of Optical Fiber Cabling Systems.
   16. ANSI/TIA-606-B – Administration Standard for the Commercial Telecommunications Infrastructure
   17. TIA/EIA-607-B - 2011 - Commercial Building Grounding and Bonding Requirements for Telecommunications
   18. Institute of Electrical and Electronic Engineers (IEEE 802.xLAN)
   19. TIA/EIA 942 Data Center Standards
   20. Current BICSI Telecommunications Distribution Methods Manual
   21. NFPA 70 – National Electrical Code (NEC).
   22. BICSI – TDMM, Building Industries Consulting Services International, Telecommunications Distribution Methods Manual (TDMM).

C. Governing Codes and Conflicts: If the requirements of these specifications or the Project Drawings exceed those of the governing codes and regulations, then the requirements of these specifications and the Drawings shall govern. However, nothing in the Drawings or Specifications shall be construed to permit work not conforming to all governing codes, regulations, and manufacturer installation requirements.

1.5 ABBREVIATIONS

A. The following abbreviations are used in this document:

IDF	Intermediate Distribution Frame
MDF	Main Distribution Frame
UTP	Unshielded Twisted Pair
SCS	Structured Cabling System
RCDD	Registered Communications Distribution Designer

1.6 SUBMITTALS

A. Project Initiation: Within fourteen (14) days of Notice to Proceed, the data network 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 cable, patch panels, cross-connect blocks, cable supports, cable labels, outlet devices, and other products to be used in the installation. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner / Designer) and the manufacturer's supporting documentation demonstrating compatibility with other related products shall be included. The submittal shall have some type of distinguishing marker or pointer to indicated what specific product is to be provided
3. Construction Schedule: A time-scaled Construction Schedule, using PERT/CPM, indicating general project deadlines and specific dates relating to the installation of the cable distribution system.
4. Testing: Proposed Contractor UTP cable test result forms, fiber optic cable test result forms and a list of instrumentation to be used for systems testing.
5. Specification Compliance: A letter shall be provided stating, by section and subsection, that the SCS installer complies with the entire specification section. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been approved by the Owner.
6. Each Submittal must have a detailed parts list with quantities.
7. Certifications: The contractor shall submit all certifications for approved products and the certifications must contain dates which are valid from the date of proposal and not expirer any sooner than 12 months after substantial completion of the project.
    a. BICSI RCDD Certification: This certification must be held by an on-staff, full-time employee of the SCS installer. The holder must be staffed out of the office that is located within 75 miles of the projected.
    b. Certifications must be obtained by the SCS installer's office that is located within 75 miles of the project and shall be a company certification, not and individual certification.
    c. Certifications must be held by at least 25% of the, on-site, staff and be made available at the site if requested by the owner, architect, and/or project's technology consultant.
    d. Fiber Optic Technician Certification: This certification must be held by

the on-staff/on-site individual that is supervising the fiber optic installation and performing the fiber optic terminations and testing.

B. Shop Drawings: 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 BICSI certified RCDD (Registered Communications Distribution Designer). The RCDD certification must be current. Identifiable, separate routing shall be shown for both the station cabling and the MDF-to-IDF tie cabling.
   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 wall penetrations (all penetrations shall be sleeved and contain protective bushings at both ends)
      b. Location of sleeved wall pass-thru
      c. Size of sleeve at each location installed
      d. Quantity of cable passing through each sleeve
      e. Location of drops in each room (quantity or labeling of drops are not required in the submittal plans. Labeling shall be provided in the closeout plans and quantities shall be as per the contract documents, addendums, and issued changes. Each drop shall be labeled for the type of outlet that it is)
      f. Conduit routing, size, quantity, and stub-up locations for all floor mounted outlets.
   3. Drawing Compliance: A letter shall be provided stating that the SCS installer complies with the entire project drawing, including all general, keyed, and notes to contractor. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been approved by the Owner.
   4. All subcontractors shall provide submittals to general contractor for normal distribution to Architects, Engineers and the Owner's project managers.

C. At Substantial Completion: Provide drawings, to the Owner, to reflect installed cabling with correct labeling and cable routing.

D. Close-out Procedures: Two (2) copies of the following documents shall be delivered to the building owner's representative at the time of system acceptance. Close out technology documents shall be separated from all other trade's documents. The close out finals shall include:
   1. Inspection and Test Reports: During the course of the Project, the Contractor shall maintain an adequate inspection system to ensure that the materials supplied, and the work performed, conform to contract requirements. The Contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion.
   2. 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 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 structure cabling system from the original approved shop drawings. Drawings shall consist of a scaled plan of each building showing the placement of each individual item of the technical cabling system equipment as well as raceway size and routing, junction boxes, and conductor size, quantity, and color in each raceway.
7. As-built Drawings shall include cable pathways, camera locations with correct labeling and MDF/IDF locations. A copy of the As-Built drawings reflecting the final locations of all cabling shall be given to the designated Owner's representative. The as-built drawings shall be prepared using AutoCAD 2012 or later. Provide the Owner with electronic versions of the as-builts on CD media.
8. All drawings must reflect final graphic numbering, point to point wiring, device address and programmed characteristics as verified in the presence of the engineer and/or the end user unless device addressing is electronically generated, and automatically graphically self-documented by the system.
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. Minimum amount of training time shall be at least 4 hours.
13. One (1) 30" x 42" laminated floor plan sheets illustrating technology drops and cable designation with final graphic numbering. Contractor shall provide one complete floor plan sheet for each telecommunications room (MDF or IDF)

PART 2 - PRODUCTS

2.1 GENERAL

A. Reference Attachment 'B' to this specification, which contains the minimum materials list for this specific project.

B. Installation: The cabling shall be installed per requirements of the manufacturer and the Project Documents utilizing materials meeting all applicable TIA/EIA standards. The Contractor is responsible for providing all incidental and/or miscellaneous hardware not explicitly specified below as required for a complete and operational system.

C. Materials shall be as listed or shall be approved equivalent products of other manufacturers meeting the intent and quality level of the TIA/EIA specifications.

D. Testing: All installed cabling shall be tested 100% good after installation by the Contractor. All final test results shall be delivered to owner at completion of project. Refer to closeout requirements.

E. Ratings: All products shall be new and brought to the job site in the original manufacturer's packaging. Electrical components (including innerduct) shall bear the Underwriter's Laboratories label. All communications cable shall bear flammability testing ratings as follows:

CM Communications Cable

CMP Plenum Rated Communications Cable
CMR Riser-Rated Communications Cable

F. Initial Cable Inspection: The Contractor shall inspect all cable prior to installation to verify that it is identified properly on the reel identification label, that it is of the proper gauge, containing the correct number of pairs, etc. Note any buckling of the jacket that would indicate possible problems. Damaged cable or any other components failing to meet specifications shall not be used in the installation.

G. Cable Lubricants:
1. Lubricants specifically designed for installing communications cable may be used to reduce pulling tension as necessary when pulling cable into conduit.
2. Approved Products
a. Twisted-pair cable: Dyna-Blue
b. American Polywater

H. Fire Wall Sealant:
1. Any penetration through firewalls (including those in sleeves) will be resealed with an Underwriter Laboratories (UL) approved sealant.
2. Approved Products
a. 3M or
b. Pre-approved equal

2.2 DATA CLOSET (MDF/IDF) HARDWARE

A. Equipment Cabinets/Cabinets: Provide and install equipment cabinets and/or cabinets in locations indicated on the attached drawings for the following areas.
1. For all MDF/IDF locations: Contractor shall provide and install a new floor mounted cabinet/rack system or a wall mounted cabinet where indicated on plans. Refer to floor plan and enlarged MDF/IDF room layouts for number of cabinets/racks to provide at each location. If an enlarged detail is not available, the contractor shall provide the required number of racks to accommodate 100% of all termination components and an equal amount of owner equipment; as well as (1) spare rack. If an MDF/IDF is located in shared space, the contractor shall provide a floor supported, wall mounted cabinet system with all required doors and side panels to secure the equipment and termination components.

B. Distribution Cabinet/Cabinet Grounding: All Cabinets and/or Cabinets shall be grounded using stranded #6 AWG insulated copper conductor. Connect to service entrance grounding electrode. Provide all required bonding materials and hardware and bond to building grounding electrode subsystem at building electrical service entrance.

C. Fiber Optic Patch Panels:
1. The enclosures used shall provide termination panels for the specified type of connectors and be of sufficient size and capacity to terminate 110% of the fiber count of the inside of outside fiber optic cables. Patch panels must be 19” cabinet mountable. Provide all termination accessories, fiber patch cords, enclosures and test for a complete fiber optic distribution system.
2. Provide closet connector housing panels, size for 110% of total fiber count to be terminated.
3. ALL fiber strands must be terminated in fiber housing.

D. Patch Panels:
1. All patch cables shall be modular type patch panels to allow individual jacks to be inserted. All patch panels shall be fully populated with Jacks. Provide dust

caps for all unused jacks. Furnish units that adhere to the performance requirements TIA/EIA-568A standards.

2. Provide cable support bars at the back of all patch panels to provide additional support at rear of panels. Provide one (1) support bar for each row of 24-ports. Support bars will not be required if the closet design consist of rear horizontal cable management above and below each patch panel.

E. Rack Electrical:
   1. A power strip shall be installed vertical at the back of each data relay rack.
   2. Project electrical contractor to provide and install one electrical receptacle for each UPS installed on the entire project. Coordinate receptacle type and location with the installed product requirements and the technology consultant prior to installation.

F. Cable Management Panels:
   1. Provide cable management panels as required for vertical cable management on ends and in between all racks on entire project.
   2. Provide Velcro straps for cable dressing in MDF/IDF rooms.

G. MDF/IDF Patch Cables:
   1. Cabling Contractor shall provide owner with one (1) patch cable for each data drop on entire project. These cables will provide connectivity from the front of the network patch panels to the network equipment. The patch cables are to be terminated properly with RJ-45 connections on each end with the proper pin-out assignments per project configuration.
   2. All patch cables shall be factory terminated. NO EXCEPTIONS.

2.3 CABLE ROUTING/PATHWAY

A. Cable Tray:
   1. Metal cable tray shall be provided to affix to the top of all floor mount cabinets. Cable tray shall be used to brace cabinets to walls and to route cable from walls to cabinets in communication closets.
   2. Contractor to provide and install all applicable installation accessories.

B. Cable Support System:
   1. All low voltage cabling shall be installed and supported using an approved cable support system installed at 48” intervals unless installed in conduit. Do not exceed manufacturer’s recommendation for the quantity of cables supported in an individual support.
   2. Cable supports shall not connect to any ceiling grid wire or on any support attached to the ceiling grid.
   3. Cable supports shall not exceed a serviceable height of more than 5’, but no closer than 2’, above the finished ceiling.
   4. Cable supports can be attached to vertical walls or the building’s structure.
   5. If attached to the building’s structure, 3/8” threaded rod shall be utilized to extend down within the serviceable heights mentioned above. Grid wire hangers will not be accepted.

C. All cable bundles shall be grouped together using plenum rated Velcro for the entire run above and below the ceilings.

D. Conduit Bushings shall be installed prior to the installation of any cable. If cable is found to be installed without the bushing the cable will have to be removed and re-installed. No cut bushings will be accepted. If cable damage occurs during any portion of the installation, the cable will be removed and replaced at no cost to the project. This item

will be strictly enforced and adhered too.

E. The projects electrical contractor shall provide and install all metallic conduit and backboxes indicated to be installed on the drawings. It is the SCS installer's responsibility to coordinate all conduit requirements with the electrical contractor to ensure that all conduit sizes and locations are correctly installed. If box locations and conduit sizes are found to vary from the project documents after installation the SCS installer will bare all financial responsibility to ensure these items are installed correctly. The RCDD for the SCS will be responsible for ensuring conduit sizes are sufficient for cable count while maintaining a 40% fill ratio. If there is not electrical contractor on the project, the SCS Installer shall bear responsibility for the provision and installation of all required raceways.

2.4 STATION WIRING

A Wire: The data and voice wire provided for all outlets shall be four-pair, solid copper conductor, meeting the intent and quality level of the TIA/EIA-568 Commercial Building Wiring Standard.

B. Testing: The four-pair UTP cable must be UL Performance Level tested. Each 1000-foot spool must be individually tested with test results affixed to the spool. All cable must be provided on new 1000-foot spools. No shorts will be allowed.

C. Rating: Cable installed in conduit shall be non-plenum rated. Cable not installed in conduit shall be plenum rated if installed in plenum ceiling space, non-plenum rated otherwise.

D. All cable shall be routed to the center of the room in which it is serving and then route to the outlet location that it is intended for. Provide a 5' service loop in the center of the room and 5' service loop at each workstation outlet properly supported above ceiling. All workstation service loops shall be made in figure eight configurations, no exceptions.

E. Provide minimum of 10' service loop at all headend locations properly supported above ceiling.

F. Provide indoor/outdoor, plenum rated category cable at any outdoor data outlet or data outlets served by cabling that travels through subsurface conduit. This applies to station or horizontal cable runs only.

2.5 STATION HARDWARE

A. Information Outlet / Jack Modules:
1. Shall be high quality 8p/8c modular jacks with circuit board construction and IDC style or 110-style wire, T568B terminations. Jacks shall meet EIA/TIA TSB40 recommendations for connecting hardware
2. Shall be standard 8-position, RJ-45 Style, FCC compliant
3. Shall be designed for 4-pair, 100 Ohm balanced UTP Cable
4. Shall terminate 26-22 AWG solid or stranded conductors
5. Shall accept FCC compliant 6 position plugs.
6. Shall have attached wiring instruction labels to permit either T568A or T568B wiring configurations.
8. Shall meet or exceed transmission requirements for connecting hardware, as specified in ANSI/TIA/EIA-568-C2, Transmission Performance Specifications for 4-Pair 100 Ohm.
9. Shall be UL Listed and CSA certified.
10. Each jack shall have category rating identified on the front face.

B. Faceplates:
   1. Standard faceplates shall be a minimum of 4-port.
   2. Wall mounted telephone faceplates shall be 1-port.
   3. All faceplates shall be single gang.
   4. All blank inserts color shall be coordinated prior to procurement.

C. Outlet Patch Cables: Cabling Contractor shall provide owner with patch cable for each data drop on entire project. Each cable will be terminated properly with RJ45 connections on each end with appropriate pin-out assignments per project configuration.
   1. Cabling Contractor shall provide owner with patch cable for each data drop on entire project. Each cable will be terminated properly with RJ45 connections on each end with appropriate pin-out assignments per project configuration.
   2. Patch cords shall be stranded copper, matching the category of the installed cable.
   3. All patch cables shall be factory terminated. No exceptions

2.6 FIBER OPTIC PRODUCTS

A. Multimode: 50/125um, OM4+, multimode fibers, each with a color-coded PVC tight buffer shall have a maximum attenuation of 3.5 dB/km at 850 nm and 1.5 dB/km at 1300 nm. Minimum bandwidth shall be 2000 MHz/km at 850 nm and 500 MHz/km at 1300 nm.

B. Singlemode: Single mode fibers, each with a color-coded PVC tight buffer shall have a maximum attenuation of 1.0 dB/km at 1310 nm and 1.0 dB/km at 1550 nm.

PART 3 - EXECUTION

3.1 GENERAL

A. Fire Wall Penetrations: The contractor shall avoid penetration of fire-rated walls and floors wherever possible. Where penetrations are necessary, they shall be sleeved with metallic conduit and resealed with an Underwriter Laboratories (UL) approved sealant. Contractor shall also seal all floor, ceiling and wall penetrations in fire or smoke barriers and in the wiring closet.

B. Allowable Cable Bend Radius and Pull Tension: In general, communications cable cannot tolerate sharp bends or excessive pull tension during installation. Refer to the cable manufacturers allowable bend radius and pull tension data for the maximum allowable limits.

C. Cable Lubricants: After installation, exposed cable and other surfaces must be cleaned free of lubricant residue.

D. Pull Strings: Provide pull strings in all new conduits, including all conduits with cable installed as part of this contract. Pull test is not to exceed 200 pounds. Data and video cables can be pulled together with pull strings.

E. Conduit fill shall not exceed 40%.

F. Damage:
   1. The Contractor shall replace or rework cables showing evidence of improper handling including stretches, kinks, short radius bends, over-tightened bindings, loosely twisted and over-twisted pairs at terminals and cable sheath removed too far (over 1-1/2 inches).

2. The Contractor shall replace any damaged ceiling tiles that are broken during cable installation.

G. Clean Up: All clean up activity related to work performed will be the responsibility of the Contractor and must be completed daily before leaving the facility.

H. Conduit and Back Boxes:
1. The Contractor shall ensure that the appropriate back boxes and conduits, for the project, are provided as required.
2. One (1) 1" conduit will be required each outlet that serves one to a maximum six (6) category 6 or a maximum of four (4) category 6A cables. Provide additional conduit for cable counts that exceed this number.
3. One (1) double gang deep box will be required for each technology outlet. All boxes except Presentation outlets will be required to have a single gang reducer ring.

3.2 EQUIPMENT CABINET CONFIGURATION

A. Equipment Cabinets: Equipment racks shall be assembled and mounted in locations shown on the Drawings and as detailed. Each rack shall be securely mounted to the floor and braced to the wall with cable tray in accordance with the manufacturer's instructions and recommendations. Racks shall be mounted such that the side rails are plumb with vertical cable management panels. Racks to be located such that future expansion can occur without relocating existing racks. Racks shall be grounded in accordance with NEC requirements.

B. Wire Management Components: Horizontal cable management panels shall be installed directly above and below each patch panel. Vertical cable management panels shall be installed on each side of the cabinet.

C. Cable Placement: Cable installation in the Wiring Closet must conform to the Project Drawings. All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance location. Avoid crossing area horizontally just above or below any riser conduit. Lay and dress cables to allow other cables to enter the conduit/riser without difficulty at a later time by maintaining a working distance from these openings.

D. Cable Routing: Cable shall be routed as close as possible to the ceiling, floor or corners to ensure that adequate wall or backboard space is available for current and future equipment. All cable runs within the Wiring Closet shall be horizontal or vertical within the constraints of minimum cable bending radii. Minimum bend radius shall be observed. Cables shall not be tie-wrapped to electrical conduit or other equipment.

E. Installation: All incoming cables shall be routed on the cable tray and neatly dressed down to the patch panels. Cable bundles shall not exceed more than 48 cables to patch panel.

F. Hardware: Provide cabinet and jack panel hardware as required for all data station wiring.

3.3 STATION WIRING INSTALLATION

A. General:
1. Cabling between wiring closet and workstation locations shall be made as individual home runs. No intermediate punch down blocks or splices may be installed or utilized between the wiring closet and the communications outlet at

the workstation location.

2. All cable must be handled with care during installation so as not to change performance specifications. Factory twists of each individual pair must be maintained up to the connection points at both ends of the cable. There shall never be more than one and one-half inches of unsheathed UTP cable at either the wiring closet or the workstation termination locations.
3. All cable shall be routed to the center of the room in which it serves before routing to the outlet location and a 5' service loop shall be provide. An addition 5' service loop shall be provided above ceiling at the outlet location. All service loops shall be figure 8 loops.

B. Exposed Cable:
1. All cabling shall be installed inside walls or ceiling spaces whenever possible. Exposed cables and/or cables routing through mechanical rooms, electrical rooms, or restrooms shall be installed inside conduits, unless noted otherwise on the project drawings.
2. Additional exposed cable runs will require Owner approval and will only be allowed when no other options exist.
3. All cable routing through conduits and sleeves shall maintain a 40% maximum conduit fill ratio.

C. Placement: All cabling and associated hardware shall be placed so as to make efficient use of available space. All cabling and associated hardware shall be placed so as not to impair the Owner's efficient use of their full capacity.

D. Cable Routes:
1. All cabling placed in ceiling areas must be in conduit, or Panduit Corp. J-MOD modular cable support with Velcro cable wrap at each location. Cable supports shall be permanently anchored to building structure or substrates. Provide attachment hardware and anchors designed for the structure to which attached and that are suitably sized to carry the weight of the cables to be supported. Do not route cable through webbing of structural steel. Cabling must be supported in dedicated supports intended to support cabling as described in this section. Contractor shall adhere to the manufacturer's suggested fill ratio for each size cable support installed. No support shall have more than 48 cables.
2. Attaching cable to pipes or other mechanical items is not permitted. Communications cable shall be rerouted so as to provide a minimum of 18 inches spacing from light fixtures, sources of heat, power feeder conduits and EMI sources. Cabling shall not be attached to ceiling grid support wires. Cable runs shall be routed down the corridors; parallel or perpendicular to building structure. Multiple cables to be bundled together at and between each cable support installed.
3. Contractor shall be responsible for coordinating with other trades on the project so that the installed cable pathway does not interfere with the installation of other systems to insure that mechanical ducts, pipes, conduits, or any other above ceiling systems are not putting unnecessary stress on any portion of the install SCS.
4. All (48) cable bundles shall be routed directly to the MDF or IDF that serves the area. All bundles shall remain separated for the length of the cable run.
    a. Provide data outlet for irrigation controllers. Coordinate location with landscape consultant.
    b. Provide data outlet for time clock appliance in main custodian office.
    c. Provide OSP or flooded/gel filled cat6 cable at any outdoor data outlet or data outlets served by cabling that travels through subsurface conduit. This applies to station or horizontal cable runs only.

3.4 STATION HARDWARE

A. Flush Mount Jacks shall be mounted in a faceplate with back box.

B. Placement:
   1. Where possible, the communications outlet shall be located so that its centerline is 18 inches above floor level or 12 inches above permanent bench surfaces. Outlets shall not be mounted on temporary, movable, or removable surfaces, doors, or access hatches.
   2. Outlets shall be installed within 3’-0” of power outlets

C. RJ-45 Jack Pin Assignments:
   1. Pin connections for data station cable outlets and patch panels shall match EIA/TIA 568 modular jack wiring recommendation T568B.
   2. Pin connections at data jack panels shall match pin connections at outlets (straight through wiring)

3.5 CABLE TESTING REQUIREMENTS

A. Notification: The Owner and Engineer shall be notified one week prior to any testing so that the testing may be witnessed.

B. Inspection: Before requesting a final inspection, the Contractor shall perform a series of end-to-end installation performance tests. The Contractor shall submit for approval a proposal describing the test procedures, test result forms and timetable for all copper and fiber optic cabling.

C. Procedures:
   1. Trained personnel shall perform all testing. Acceptance of the test procedures discussed below is predicated on the Contractor’s use of the recommended products and adherence to the inspection requirements and practices set forth. Acceptance of the completed installation will be evaluated in the context of each of these factors.
   2. Acceptance shall be subject to completion of all work, successful post-installation testing which yields 100% PASS rating, and submittal and approval of full documentation as described above. Tests with the "* PASS" (asterisk) will not be acceptable. These circuits must be repaired to meet "PASS".

E. Errors: When errors are found, the source of each shall be determined, corrected and the cable retested. All defective components shall be replaced and retested. Re-test results must be provided on Owner approved forms and witnessed by Owner.

F. Twisted Pair Cable Testing:
   1. At a minimum, the Contractor shall test all station drop cable pairs from Data Closet termination patch panels to outlet device RJ45 jacks. Products shall be tested for compliance with ANSI/TIA/EIA 568A and ISO/IES 11801. Test equipment used shall meet TIA/EIA TSB-67, Level II accuracy. Further, the contractor shall have a copy of TSB-67 in their possession and be familiar with its contents.
   2. Each wire/pair shall be tested at both ends for the following:
      a. Wire map (pin to pin connectivity)
      b. Length (in feet)
      c. Attenuation
      d. Near end cross talk (NEXT)
      e. Power Sum
   3. Test equipment shall provide an electronic and printed record of these tests.

4. Test results for each four-pair UTP cable must be submitted with identification to match labels on all patch panel ports and RJ45 jacks and must match as-builts associated with that cable.

G. Fiber Optic Cable Testing:
1. Testing device for fiber optic cables shall be a high quality OTDR (Optical Time-Domain Reflectometer) equipped with a printer. The printed data shall show, in addition to any summary information, the complete test t0.and all relevant scale settings. The OTDR must have the capability to take measurements from bare fiber strands as well as SC connector terminations.
2. All fiber optic cable shall be tested on the reel before installation to ensure that it meets the specifications outlined herein.
3. After installation the Contractor shall test each fiber strand in accordance the EIA 455-171 Method D procedures (bi-directional testing) at both 850nm and 1300nm for multimode or 1310nm and 1550nm for single mode. A form shall be completed for each cable showing data recorded for each strand including length, total segment (end-to-end) loss (dB) and connector losses (dB) at each end. In addition, the printed data strip for each strand shall be attached to the form. Patch cables shall also be tested.
4. Acceptable fiber optic connector loss shall not exceed .75dB per mated pair. The Contractor is responsible for obtaining minimum loss in fiber connections and polishing per manufacturer specifications.
5. Singlemode fibers shall have a maximum attenuation of 1.0 dB/km at 1310 nm and 1.0 dB/km at 1550 nm.
6. Multimode: 50/125um micron multimode fibers shall have a maximum attenuation of 3.5 dB/km at 850 nm and 1.5 dB/km at 1300 nm. Minimum bandwidth shall be 2000 MHz/km at 850 nm and 500 MHz/km at 1300 nm.

3.6 INSPECTION

A. Conformance to the installation practices covered above is to be verified when completed. In some cases, the Owner/Designer may inspect before acceptance.
1. Written Test Report:
a. Complete test results, including actual values associated with tests.
b. Show all certifications for telecommunications wiring systems.
c. Include cable maps showing each cable route and keyed to cable labels. Provide owner with complete floor plans identifying outlet location and cable routing drawing in AutoCAD format. Provide electronic copy of drawings to owner in AutoCAD version 2012 or greater.
d. Documentation of outlet, cable and cabinet labeling system.

B. After performing all tests, tabulate results and bind together in format acceptable to Owner. Installer shall provide written certification in the test report that telecommunications cable is properly installed, and test results certify system to all specified standards.

ATTACHMENT 'A'

PROJECT SPECIFIC SCOPE OF WORK AND INSTRUCTIONS

PART 1 – SUMMARY OF WORK

1.1 DESCRIPTION OF WORK

A. This project consists of the provision and installation of a Structured Cabling System (SCS) as required to support network connectivity to workstations, telephones, video surveillance, access control, building automation, electrical lighting, and any other system requiring network connectivity. This project is a new, _____ Square Foot, _____ for _____. The project site will be located at _____ Rd., City of _____, State, ZIP Code.

B. The work includes provision and installation of a complete Cabling System (SCS) in compliance with these specifications and associated drawings, pre-proposal addenda, change orders, change directives and any other documents issued both pre-proposal and during the project.

C. The SCS Installer shall comply with all conditions of the contract and "Division 1 – General Requirements" as they apply to the SCS Scope of Work. It shall be the responsibility of the SCS Contractor to make themselves familiar with all documents.

D. It should not be assumed that any portions of a complete and functional system are to be *furnished and/or provided by anyone, other than the SCS installer, unless specifically stated otherwise.*

E. Division of responsibilities:
OFOI = OWNER FURNISHED AND OWNER INSTALLED
CFCI = CONTRACTOR FURNISHED AND CONTRACTOR INSTALLED
1. CATEGORY 6A CABLING – OFOI
2. MDF/IDF NETWORK EQUIPMENT – OFOI
3. VOIP TELEPHONES – OFOI
4. WIRELESS ACCESS POINTS – OFOI
5. UNINTERRUPTIBLE POWER SUPPLIES – OFOI
6. RACEWAY: CONDUIT, BACK BOXES, SLEEVES, ETC – CFCI

1.2 STRUCTURED CABLING SYSTEM – ADDITIONAL INSTRUCTIONS

A. Base Proposal:
1. The SCS Installer shall provide and install a Commscope/Systimax End-to-End Structured Cabling System as per these specifications and associated drawings. The Base bid SCS shall consist of:
   a. Category 6A cable and connectivity to each Video Surveillance Camera, Voice/Data Outlet, Access Controlled Door, and any other locations requiring Local Area Network Connectivity.
   b. Category 6A cable and connectivity to each Wireless Access Points.
   c. Each connectivity solution be a complete Channel Solution; consisting of jacks, patch panel, and patch cables.
   d. Each channel solution shall be color coded to the system in which it serves.
2. The products specified in Attachment 'B' are intended to establish quality, functionality, color, and standards. The following shall be considered preapproved equivalent for each specific portion of the SCS.

a. Category 6A copper cable
   1) Commscope/Systimax
b. Category 6A copper cabling, termination components, and patch cables
   1) Commscope/Systimax
c. Fiber Optic Cabling and Components:
   1) Commscope
d. Metals (racks, cable managers, and cable tray):
   1) Commscope
e. Manufacturer approval request must be submitted in compliance with the Division 1 instructions and must be received no less than ten (10) business days prior to the posted proposal submission date. No substitutions will be allowed if not submitted per these instructions and approved via official pre-bid addendum.

1.3 COPPER PATCH PANELS

A. The SCS Installer shall provide and install patch panels as per the instructions below.
   1. 24-port patch panels shall only be used for copper tie cables and demarcation extensions.
   2. Provide dedicated, 48-port patch panels for each of the following system (reference color code chart for designated insert and patch panel color coding per system):
      a. LAN and IP Telephones
      b. Wireless Access Points
      c. IP Intercom
      d. Video Surveillance Cameras

1.4 COPPER AND FIBER OPTIC PATCH CABLE LENGTHS

A. The SCS Installer shall provide copper and fiber optic patch cables as per the instructions below. All patch cables shall be factory terminated and warrantied for the copper and fiber solutions specified.
   1. MDF/IDF Copper Patch Cables:
      a. Patch cables shall be category 6A
      b. Provide one patch cable for each port on the entire project
      c. Patch cables to be installed by network equipment installer/programmer
      d. Patch cable lengths
         1) 95% shall be 5’
         2) 5% shall be 7’

   2. Work Area Outlet Copper Patch Cables:
      a. Patch cables shall be category 6A
      b. Provide one patch cable for each port on the entire project
      c. Patch cables to be installed by the owner.
      d. Patch cable lengths
         1) 90% shall be 10’
         2) 10% shall be 15’

   3. Wireless Access Point Copper Patch Cables:
      a. Patch cables shall be category 6A
      b. Provide one patch cable for each port on the entire project
      c. Patch cables to be installed by wireless system installer.
      d. Patch cable lengths
         1) Interior Ceiling Access Points: 100% shall be 1.5’

2) Interior Wall Mounted Access Points: 100% 1'
3) Exterior Access Points: 100% shall be 15'

4. Video Surveillance Camera Copper Patch Cables:
   a. Patch cables shall be category 6A
   b. Provide one patch cable for each port on the entire project
   c. Patch cables to be installed by the Video Surveillance System Installer.
   d. Patch cable lengths
      1) Interior Ceiling Cameras: 100% shall be 1.5'
      2) Interior Wall Mounted Cameras: 100% 3'
      3) Exterior Cameras: 100% shall be 15'

5. IP Intercom Copper Patch Cables:
   a. Patch cables shall be category 6A
   b. Provide one patch cable for each IP Intercom device on the entire project, plus an additional twenty (20) for future use.
   c. Patch cables to be installed by the IP Intercom System Installer.
   d. Patch cable lengths
      1) Interior Ceiling Speakers: 100% shall be 1.5'
      2) Interior Wall Mounted Speakers: 100% 1'
      3) Exterior Speakers: 100% shall be 15'

6. MDF/IDF Fiber Optic Patch Cables:
   a. Patch cables shall be OS2 (Single-mode).
   b. Patch cable shall be duplex, LC to LC
   c. Provide quantity sufficient for connecting all network equipment plus 20% for growth.
   d. Patch cables to be installed by network equipment installer/programmer
   e. Patch cable lengths
      1) 100% shall be 3 meters

7. Prior to submittal and procurement of fiber optic and copper patch cables, the contractor shall coordinate with the project Consultant and Owner of final requirement for cable lengths on the specific project.

1.5 SYSTEM SPECIFIC COLOR REQUIREMENTS

A. The following information shall apply to the complete SCS Channel. All cable, patch cables, outlet terminations, and closet terminations shall be provided in the colors designated below:

Item	Description	Horizontal Cable	Insert	Patch Cables
1	Data	Blue	Blue	Blue
2	VoIP Telephone	Blue	Blue	Blue
3	Wireless	Orange	Orange	Orange
4	Camera	Lilac	Lilac	Lilac
5	Access Control	Lilac	Lilac	Lilac
6	Intrusion Detection	Lilac	Lilac	Lilac
7	PA System	White	White	White

1.6 DOCUMENTATION

A. Labels:
The Contractor will label all outlets using permanent / legible typed or machine engraved labels approved by the Owner (no handwritten labels permitted). Label patch panels in the wiring closet to match those on the corresponding data outlets. The font shall be at least one-eighth inch (1/8") in height, block. All labels shall correspond to as-builts and to final test reports.

1. The following nomenclature shall be used when labeling data/voice jacks:
    a. All cables being served by MDF closet shall begin with 'A' all IDF served cables shall begin with numerical digit 'B' thru 'Z') designating the specific IDF's identification.
    b. Next identification character shall be a numeric digit identifying the specific patch panel that is serving outlet (1, 2, 3…)
    c. Next identification shall note what # data port on patch panel (01 thru 48).

Example:
Label of an outlet from 23rd port of the third patch panel from top of rack located at IDF-2 shall read: C-3-23
Label of an outlet from the 5th port of the second patch panel from the top of rack located in the MDF shall read: A-2-05

B. Floor Plan:
A floor plan clearly labeled with all outlet jack numbers shall be included in the as-built plans.

C. Cables: All cables shall be labeled at both ends. This includes but not limited to horizontal voice and data cabling, copper backbone tie cables, and fiber optic cables.

D. Fiber Optics: Fiber optic strands shall be labeled at both ends on the fiber distribution panel.

E. Equipment racks: Equipment racks shall bear at least one indicating label indicated MDF or IDF. If rack is installed in IDF, label shall include IDF #.

F. Access Points: Label ceiling grid with digital label according to location installed and a bright orange ¾" round dot sticker.

ATTACHMENT 'B'
MANUFACTURER AND MATERIAL LIST

The Communications Contractor shall perform no portion of the work requiring submittal and review of record drawings, shop drawings, product data, or samples until the respective documentation has been approved by project's Technology Consultant.

MATERIAL LIST

MANUFACTURER	DESCRIPTION	PRODUCT NUMBER	NOTES
Commscope	4-post Equipment Rack (45U) 12-24 Tapped Rails, Black	760082560 | RK4P45-36A	Provide as shown on Drawing, minimum of one (1) in the Building's MDF.
Commscope	2-post Equipment Rack (45U) 12-24 Tapped Rails, Black	760082479 | RK3-45A	Provide as shown on Drawing, minimum of one (1) in the Building's MDF and each IDF.
Chatsworth	12U-21U wall mount cabinet	11996-7**	CUBE-iT wall-mount cabinet. Replace ** with 24 for tempered glad door for Press box application. Replace ** with 36 for IDF application.
Commscope	Vertical Cable Management Kit, 8in W X 84in H Single Sided, Black	760244816	Provide and install between each rack and at both ends of all rack systems
Commscope / Systimax	GigaSPEED X10D® XL® M4800 1U Modular Panel, 48 port, for SYSTIMAX Category 6A and 6 Jacks	760105429 | M4800-1U-GS	Provide in quantities as required to terminate 100% of all distribution structured cabling, plus 25% for future growth. Reference project drawings. Voice/Data, Security, and WLAN shall have dedicated panels per system.
Commscope / Systimax	GigaSPEED X10D® XL® M2400 1U Modular Panel, 24 port, for SYSTIMAX Category 6A and 6 Jacks	760118323 | M2400-1U-GS	Provide in quantities as required to terminate 100% of all distribution structured cabling, plus 25% for future growth. Reference project drawings. Voice/Data, Security, and WLAN shall have dedicated panels per system.
Commscope	Copper Ground Buss Bar, 1/4 in x 4 in x 12 in	UGBKIT-0412	Provide one (1) in each MDF and IDF on the entire project
Commscope / Systimax	High Density 1U modular cassette sliding Panel, accepts (4) G2 modules or MPO panels, providing up to 48 duplex LC ports, or up to 32 MPO ports	760209940 | HD-1U	Provide as per the project drawings. Or as required, to accommodate all fiber optics in the IDFs, if not shown on drawings
Commscope / Systimax	High Density 2U modular cassette sliding Panel, accepts (8) G2 modules or MPO panels, providing up to 96 duplex LC ports or up to 64 MPO ports	760209957 | HD-2U	Provide as per the project drawings. Or as required, to accommodate all fiber optics in the MDF/IDFs, if not shown on drawings

MANUFACTURER	DESCRIPTION	PRODUCT NUMBER	NOTES
Commscope / Systimax	High Density 4U modular cassette sliding Panel, accepts (16) G2 modules or MPO panels, providing up to 192 duplex LC ports or up to 128 MPO ports	760209965 | HD-4U	Provide as per the project drawings. Or as required, to accommodate all fiber optics in the MDF/IDFs, if not shown on drawings
CommScope	Rear cable management, rack moutnable	360-RCM-RM (760104737	
CommScope	Rear cable manager bar, 19in, 5in deep	NETCONNECT (557548-1)	
Commscope / Systimax	360 Distribution Adapter Pack, Singlemode, 12 LC with internal shutters	760109389 | 360DP-12LC-SM	Provide as required to accommodate 110% of all fiber terminated in each MDF/IDF
Commscope / Systimax	360 Distribution Adapter Pack, Singlemode, 24 LC with internal shutters	760115915 | 360DP-24LC-SM	Provide as required to accommodate 110% of all fiber terminated in each MDF/IDF
Commscope / Systimax	Category 5e PowerSUM 1100 U/UTP Patch Pane, 24-port	760182907 | 1100-U-PS-24	Provide in quantities as required to terminate 100% of all copper backbone cable. Reference project drawings.
Commscope / Systimax	GigaSPEED X10D® 360GS10E Solid Cordage Modular Patch Cord	CPCSSX2-0xFyyy	x' to be replaced with alpha or numeric character depicting the color of the patch cable. 'yyy' to be replaced with a numeric value depicting the patch cable length, in feet. Colors shall comply with designated color of the system each cable is provided for. Length to comply as stated in these specifications and coordinated with the Owner's Technology department
Commscope / Systimax	CommScope® Category 6A U/UTP Cord, Plenum , RJ45 to Ceiling connector, 1.5 ft, WHITE	CCA-CAT6A-PLENUM-WHITE-N018	Provide for all above ceiling terminations (IP Intercom Speakers, Wireless Access Points, Video Surveillance Cameras, etc.)
Commscope	10 ft. x 12 in Ladder Rack Straight Section, Black	760085647 | CR-SLR-10L12W	Provide as shown on drawings. Tray shall route to and between all racks, in each MDF/IDF, on the entire project.
Commscope	Ladder Rack, 90° radius, Horizontal E-Bend Section, 12", Black	760085530 | CR90FCB-12W	
Commscope	Ladder Rack Inside Curved Section, 12", Black	760085688 | CR90ICB-12W	

MANUFACTURER	DESCRIPTION	PRODUCT NUMBER	NOTES
Commscope	Ladder Rack Outside Curved Section, 12", Black	760086082 | CR90OCB-12W	
Commscope	Rack-to-Runway Mounting Kit, black in color	760084053 | CRR2RRMK	Provide one (1) at the top of each rack and/or cabinet on the entire project.
Commscope	Ladder Rack wall angle support kit, 12", black	760084145 | CR6-12WRSK	Provide one (1) at each location where the ladder tray system terminates at a wall
Commscope	Ladder Tray Triangle Support Bracket, 12", Black	760084095 | CRTWSBK-12W	Provide every 5' of horizontal ladder tray section routing along the communication room walls.
Commscope	Vertical Wall Bracket	760084137 | CRVWBK	Provide one kit every 5' of vertical wall ladder rack, minimum of two kits at top and bottom. Contractor to provide vertical wall cable tray section at locations where the service entrance and backbone thru-floor sleeves are located
Commscope	Ladder Rack protective end cap kit (2 caps), black	760084012 | CRPECK	Provide one kit at each exposed end of ladder rack
Commscope	Ladder Tray, junction splice kit, black	760084046 | CRTJSK	
Commscope	Ladder Rack, butt splice kit, black	760083899 | CRBSK	
Commscope	Ladder Tray Radius Drop Kit, 12", Black	760083956 | CRDK-12W	Provide one (1) at each location where cable drops to the rack associated rack.
Commscope	Ladder Rack Retaining Post Kit	760083980 | CRRP-8H	Provide one (1) set at all ladder rack junctions and horizontal bends to prevent cable from dropping off thru ladder rack system.
Commscope / Systimax	GigaSPEED X10D® 2091B ETL Verified Category 6A U/UTP Cable, 4 pair count, 1000 ft length, WE TOTE® box	2091B ** 4/23 W1000	** to be replaced with numeric character depicting the color of the cable. Colors shall comply with designated color of the system each cable is provided for. **=Blue for voice/data **=Purple for security cameras, door access **=Orange for wireless **=White for intercom
Commscope / Systimax	GigaSPEED X10D® MGS600 Series Information Outlet	MGS600-yyy	yyy' to be replaced with numeric character depicting the color of the Information Outlet (IO). Colors shall comply with designated color of the system each IO is provided for. Yyy=262 for white for intercom Yyy=318 for blue for data yyy=361 for violet for cameras, access control

MANUFACTURER	DESCRIPTION	PRODUCT NUMBER	NOTES
			yyy=112 for orange for wireless
Commscope / Systimax	Single Gang, Stainless Steel, M-Series Faceplate	M1*SP	* to be replaced with a numeric character that depicts the port quantity of the faceplate. All faceplates shall be a minimum of 4-ports, with the exception of specialty outlets such as Wall Phones, Wireless Access Points, Video Surveillance Cameras, etc.
Commscope	TeraSPEED® Plenum Distribution Cable, interlocking aluminum armored with plenum jacket, 12 fiber	760127803 | P-012-DZ-8W-FSUYL	
Commscope	48 Fiber, Single Jacker/Single Armor, Gel-Free, Outdoor stranded Loose Tube Cable, Single Mode	760053280 | D-012-LA-8W-F12NS	
Commscope	12 Fiber, Riser Rated, Distribution cable, SM	760086371 | R-012-LN-8W-F12BK/25D	
Commscope	Field Installable LC Connector, SM-UPC, Blue, for 250/900u	760117895 | SFC-LCF-09-8X	1 per pack
Commscope	Field Installable LC Connector, SM-UPC, Blue, for 250/900u	760117895 | SFC-LCF-09-8X-25	25 per pack
Commscope	Singlemode LC to LC, Fiber Patch Cord, 1.6 mm Duplex, Riser	FEWLCLC42-JXM***	*** to be replaced with a numeric value depicting the cable length in meters
Commscope	25-Pair PowerSUM U/UTP 2061F Series Plenum Cables	2010B WH 25/24 R#####	Provide one (1) from the MDF to each IDF on the entire project. #### to be replaced with numeric characters that depict the cable length
Panduit	LD non-metallic series low voltage, one-piece hinged design, single channel surface raceway includes adhesive backing and is made of impact resistant material with a smooth finish that will not scratch, peel, or corrode. The raceway includes an assortment of bend radius and standard fittings that complement the offering to help route, protect, and conceal low voltage data, voice, and video cabling	Pan-Way LD surface raceway system.	Coordinate with architect and owner on color.

MANUFACTURER	DESCRIPTION	PRODUCT NUMBER	NOTES
Dynacom	Unwired, 66-Style Termination Block with clear, hinged cover	66M1-50	Provide one (1) for each 25-pair demarcation extension cable
Dynacom	66 wiring block, metal backboard, blue in color	183C*M	* to be replaced with a numeric value depicting the board size. Provide at each demarcation point for the mounting of the 66 wiring blocks. Board size shall consist two (2) mounting brackets per 25-pair cable installed.
Ditek	10GbE, Single Channel, RJ45/RJ45, PoE Surge Protector, STP Category 6/6A	DTK-MRJPOES	Provide one for each copper network cable associated with an exterior device, up to two (2) cables. Bond to TGBB per manufacturer's instructions
Ditek	Rack Mount,10GbE, 12-Channel, RJ45/RJ45, PoE Surge Protector, STP Category 6/6A	DTK-RM12NETS	Provide one for every four (4) to ten (12) copper network cables associated with an exterior device and originating at the same MDF/IDF. Bond to TGBB per manufacturer's instructions
Ditek	Rack Mount,10GbE, 24-Channel, RJ45/RJ45, PoE Surge Protector, STP Category 6/6A	DTK-RM24NETS	Provide one for every Thirteen (13) to Twenty-Four (24) copper network cables associated with an exterior device and originating at the same MDF/IDF. Bond to TGBB per manufacturer's instructions
EXTENDED DISTANCE POWERED FIBER FOR WIRELESS AP AND VIDEO SURVEILLANCE CAMERAS			
CommScope	Power Express Distribution shelf with alarm module	PFP-PX-S1	Power Express Class 2 shelf and starter kit, accommodates up to 4 modules of 8 SELV/Class 2 outputs, 1U
CommScope	Power Express Distribution module.	PFP-PX-8M	
CommScope	Power Express Blank Slot Panel	PFP-PX-SF	Provide one (1) for every empty slot.
CommScope	SPS Rectifier Power Distribution Shelf	PFP-SPS-1	
CommScope	1600W SPS Power Rectifier module	PFP-SPS-1600M	
CommScope	SPS Rectifier Controller Display	PFP-SPS-C1	Provide one per SPS Rectifier Power Distribution Shelf
CommScope	SPS Rectifier Blank Slot Panel	PFP-SPS-SF	Provide one (1) for every empty slot.
CommScope	CS34O Category 6 U/UTP filled Cable, outdoor direct burial, black jacket, 4 pair count, 1000 ft (305 m) length, reel	UN884019904/10 | CS34O BLK C6 4/24 U/UTP RL 1KFT	
CommScope	OS2, Outdoor, 4-Strand Fiber	PFC-S04012	
Transition Networks	Gigabit SFP Module	TN-GLC-LH-SM.	Provide one (1) for each POE extender.

MANUFACTURER	DESCRIPTION	PRODUCT NUMBER	NOTES
CommScope	PoE Extender, 2 Port Universal Mount, Outdoor, 60 Watt, 2-Port	PFU-P-C-0-060-02	
Hoffman	22” X “22” back panel	CP2424	
Hoffman	24”x24”x8” NEMA-4 junction box.	CSD24248	
Hoffman	Padlock Handle	CWHPTO	

END OF SECTION

SECTION 27 41 15

PERFORMANCE AUDIO-VISUAL SYSTEMS AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

B. Architectural, structural, mechanical, electrical, and other applicable documents and drawings are considered a part of the Performance Audio-Visual Systems and Equipment (hereafter referred to as AV Systems) documents insofar as they apply as if referred to in full.

1.2 DESCRIPTION OF THE WORK

A. The following systems are considered part of this project. The complete AV System for each area is comprised of several independent subsystems, and includes, but is not limited to the following areas:

01 Coordination of AV Systems needs with the electrical systems installation contractor as outlined in the Drawings and Specifications.
02 Coordination of AV Systems needs with structural systems installation contractor as outlined in the Drawings and Specifications.
03 Coordination of AV Systems needs with the technology/data systems installation contractor as outlined in the Drawings and Specifications.
04 Coordination of AV Systems needs with all other trades, as required to successfully install systems functioning in accordance with the intent expressed in the Drawings and Specifications.
05 Field-verify all conditions, dimensions, and routing. Fully comply with the Contract Documents, including, and without limitation, the need to check, confirm, and coordinate work with that of other disciplines.
06 Installation, configuration, and training for new Sound system and equipment at the Black Box as follows:
   a. Sound reinforcement system, to include all supporting amplification.
   b. Digital Signal Processing system for use with preamplification, processing, and routing of audio sources, to include all supporting network devices and companion electronics.
   c. Portable mixing console.
   d. Bluetooth / Multi-I/O connectivity to support portable audio devices as well as audio associated with OFE portable video display cart.
   e. Wired production intercom system.
   f. Wired and Wireless Microphone systems.
   g. FM Assistive listening systems for hearing-impaired accessibility.
07 Loose equipment package including microphones, stands, and cables for flexible use throughout the facility.
08 Cable, connectors, wall plates, and other hardware and accessories, as required, to furnish a complete working system.

1.3 SCOPE OF THE WORK

A. These Specifications, together with the related drawings and General Conditions of the contract, comprise the requirements for the AV Systems for the project.

B. Furnish, deliver, erect, install and connect completely all of the material and appliances described herein and in the Drawings, and supply all other incidental material and appliances, tools, transportation, etc., required to make the work complete, and to leave the Sound Systems in first class operating condition, excluding those items listed under GENERAL, 1.10, RELATED WORK IN OTHER SECTIONS.

C. Perform all assembly of equipment, wiring and inter-connection and soldering of wires to jacks, devices, terminals or equipment, using technical employees only, who are experienced in the installation of AV equipment and its inter-connection. Coordinate final utility rough-in locations with actual equipment furnished.

D. Verify dimensions and conditions at the job site prior to installation, and perform installation in accordance with these Specifications, manufacturers' recommendations and all applicable code requirements.

1.4 QUALITY ASSURANCE

A. The intent of these Specifications is to describe and provide for complete AV Systems of high professional quality and reliability. Professional performance standards by the AV Systems Contractor (hereafter referred to as Installer) and the equipment will be required.

B. In all cases, the Owner and Consultant shall determine the acceptability of the work based upon the visits, observations, and reports of the AV Systems Consultant (hereafter referred to as Consultant).

1.5 SUBSTITUTIONS

A. Refer to Division 01 for specific substitution procedures and submittal requirements.

B. Many items are listed in the Specifications by the manufacturer's type or model number, without a detailed performance specification, and may not include the phrase "or approved equal". Where this is the case, no substitutions will be accepted.

C. Where the phrase "or approved equal" appears, the item specified shall set a standard of quality and performance, based on the published specifications of the manufacturer and on the actual performance as known by the Consultant. Requests for substitution shall be submitted in writing and forwarded to the Consultant no less than five (5) business days prior to the project’s scheduled bid date. No substitution will be accepted without written approval from the Consultant to the Installer.

D. Requests for substitution, when forwarded by the Installer to the Consultant, are understood to mean that the Installer represents that he has personally investigated the proposed substitute product and determined that it is equal to or superior in all respects to that specified, that the same guarantee will be provided for the substitution as for the specified product, and that the Installer will coordinate the installation of the accepted substitute, making such changes as may be required for the work to be complete in all respects.

E. Substitutions will not be considered if they are indicated or implied in Shop Drawing submissions without previous formal request, or, for their implementation, they require a substantial revision of the Contract Documents in order to accommodate their use.

F. Space allocations and utility rough-ins have been designed on the basis of equipment items named by manufacturer and model number. If any equipment not so named is

offered which differs substantially in dimension or configuration from the named equipment, provide scaled shop drawings showing that the substitute can be installed in the space available without interfering with other trades or with access for operation and maintenance in the completed project. The Installer shall coordinate final utility rough-in locations with actual equipment furnished.

G. Many Basis of Design products are specific as to infrastructure requirements, and such infrastructure has been specifically designed for the Basis of Design products listed. Where substitute equipment requiring different arrangement or connections from those shown in the Contract Documents is accepted by the Consultant, install the equipment to operate properly and in harmony with the intent of the Drawings and Specifications, making all necessary incidental changes without increasing the Contract amount. Facilitate revisions and modifications with impacted disciplines and trades, and pay all additional costs incurred by adjoining or connecting trades for implementation of such modifications.

H. All requests for substitutions shall be submitted five (5) business days before the bid opening date. Substitutions shall be requested and approved in writing only, based upon these criteria.

1.6 INSTALLER QUALIFICATIONS

A. The work performed under this Section shall be performed by an AV Systems contractor, normally engaged in the business of AV Systems installation. The prospective contractor shall show proof, as part of the bid that the contractor has been in the AV Systems installation business for a period of not less than five years and has successfully completed projects of similar size and scope.

B. Each bidder shall hold a current, valid franchise for the major lines of sound equipment furnished by him under these Specifications.

C. The Owner and Consultant reserve the right to reject any bids submitted by firms without sufficient experience in projects of similar size and scope.

1.7 COOPERATION AND COORDINATION

A. Cooperate and coordinate as shown with the other contractors who are responsible for work not included in this section.

B. Provide any and all information as shown or requested by the Owner, Consultant, or General Contractor in order for this work to be completed to the satisfaction of the Owner, and in the best interests of the Project. Such assistance or information shall be transmitted in writing to the requesting party in all cases. All written correspondence shall be copied to the Consultant.

1.8 GUARANTEE AND WARRANTY

A. Guarantee all parts, labor, and workmanship furnished under this contract for a period of twelve months from the date of substantial completion.

B. During the warranty period, report to the site and repair or replace any defective materials or workmanship without cost to the Owner. Warranty service shall be rendered within 24 hours after request by the Owner. Equivalent replacement equipment shall be temporarily provided when immediate on-site repairs cannot be made.

C. Where warranties on individual pieces of equipment exceed twelve months, the guarantee period shall be extended to the warranty period of the particular items.

D. Furnish complete and working AV Systems. Be of maximum assistance to the Owner during the guarantee period of the system, to the degree that maximum Owner satisfaction is assured.

E. After completion of the work, the Installer shall submit a Certificate of Warranty, stating commence and expiration dates and conditions of the warranty, for signature of both parties. Incremental warranties for completed portions of the work may be negotiated at the discretion of the Owner, if delays occur beyond the control of the Installer.

1.9 SHOP DRAWINGS AND SUBMITTALS

A. Completely detailed shop drawings shall be prepared prior to the procurement of equipment or commencement of work. Electronic files of select drawings will be made available to the Installer from the Consultant. A digital files disclaimer shall be signed and returned by the Installer to the Consultant prior to release of such files. The available drawings shall include only: (1) Legend/Power requirements, (2) Conduit Riser, (3) Floor and Reflected Ceiling Plans, (4) Section Views. Drawings shall be prepared and submitted in electronic format, and as directed by the Architect. Equipment lists, data sheets, etc. shall be 8-½" x 11" size, properly bound into a single electronic format file. Submit in accordance with Division 1, General Requirements.

B. Within 10 days after the notice to proceed, submit to the Consultant identical copies of the following for approval:

01 A complete equipment list, with manufacturers' names, model numbers, and quantities of each item.
02 Manufacturers' data sheets on all equipment items.
03 Equipment rack layouts showing locations of all rack mounted equipment items.
04 Floor plans and reflected ceiling plans, prepared at a scale of not less than 1/8"=1'-0", showing loudspeaker locations and orientation, junction box and wall plate locations, and all other related device locations.
05 Proposed construction details for any manufacturer-supplied, third party, and custom fabricated items, including interface panels, patch panels and patchbays, wall plates, speaker mounts and rigging details. These details shall show dimensions, materials, finishes and color selection.
06 Coordinate with the Architect / Owner regarding color selection of each equipment item and associated mount / mounting hardware for any, and all, exposed devices. Provide factory color options for review in submittal package. The Installer shall request written confirmation from the Architect / Owner on all such devices prior to ordering. Where the Architect's color selection is not a factory color option, the Installer shall coordinate with the device manufacturer for custom color/paint, where available, and, if not available, coordinate with the General Contractor and other trades for field painting.
07 Comprehensive system schematics, showing detailed connections to all equipment, with wire numbers, terminal block numbers, and color coding.
08 Riser diagrams showing conduit requirements with pull boxes, outlet boxes, physical cable layouts, part numbers of cable types used, and number of circuits in each conduit.
09 Electrical power requirements for head-end and ancillary equipment. Include diagrams for any remote control of electrical power, in sufficient detail to coordinate with the electrical contractor, showing exact conduit requirements and locations for power service receptacles.

10 Certain other submittals as noted elsewhere in this specification, and as may be required for various equipment items prior to construction, fabrication, or finishing of that item.

11 Submission of the AV Contract Documents / Bid Documents does not constitute a legitimate submittal and will not be accepted.

C. Incomplete submittals will not be reviewed. Complete Shop Drawings and Product Data shall be submitted as a singular submittal.

D. All final documentation shall be submitted and approved before final acceptance by the Owner will be granted. Submit the following in accordance with Division 1, General Requirements. The Installer shall provide final documentation in both hard copy and electronic formats. Suitable electronic formats include Microsoft Word and Excel, AutoDesk (.dwg, .dwf), and Adobe Acrobat (.pdf).

01 A complete as-installed equipment list, listed by room, with manufacturers' names, model numbers, serial numbers, and quantities of each item.

02 A complete and correct system schematic, showing detailed connections for all parts of the system, including wire numbers, terminal block numbers and layouts, and other designations and codes. System performance measurements as noted elsewhere in this specification shall be documented. Include diagrams or charts showing final settings of all control knobs in the system (mixers, equalizers, power amplifiers, etc.). Submit copies of software settings of each piece of equipment that is software controlled.

03 Network configuration and routing settings for all network-connected equipment in scope including, but not limited to, the following:

a. Full IP settings and addressing for each device.

b. Network switch configurations, to include settings for VLANs, QoS, DiffServ, IGMP, and any other setting required for proper AV-network performance.

c. Configuration and routing parameters for any Audio / AV-over-IP protocol, to include Dante, QLan, AES67, AVB, Milan, or any other standard protocol, variant, or proprietary communication platform.

04 Complete equipment rack layouts showing locations of all rack mounted equipment items.

05 Floor plans and reflected ceiling plans, prepared at a scale of not less than 1/8"=1'-0", showing loudspeaker locations and orientation, wall plates, rack locations, and other related device locations.

06 Riser diagrams showing as-installed conduit with pull boxes, outlet boxes, physical cable layouts, part numbers of cable types used, and number of circuits in each conduit.

07 Repair parts lists for each and every major equipment item furnished.

08 Manufacturer's warranties and operating instructions for each and every equipment item furnished. Include a copy of the certificate of warranty, signed by both parties.

09 Technical Systems Operations Manual, custom-written by the Contractor, for the purpose of instructing the Owner's operating personnel in the detailed step-by-step operation of the system and preventive maintenance procedures. This manual shall include descriptions of the system components and their relationship to system function. This manual shall be bound separately and labeled appropriately.

10 Incomplete submittals will not be reviewed.

1.10 RELATED WORK IN OTHER SECTIONS

A. All conduit with pull strings, all electrical pull boxes, and all outlet boxes shall be furnished and installed under the electrical section of Division 26. Coordinate as necessary for proper installation.

B. All 120VAC power conductors and conduits associated with power circuits to all equipment locations shall be furnished and installed under the electrical section of Division 26. The 120VAC power to the equipment racks shall be terminated inside the racks to AV Installer-supplied isolated ground multi-circuit modular raceway receptacles.

C. An insulated THW stranded copper ground wire, sized according to NEC, shall be installed under the electrical section of Division 26 from the equipment racks sheet metal to the primary ground point within the building, and terminated at each end to bare metal using approved connectors and clamps.

D. All built-in millwork and any grille cloth shall be furnished under other sections.

E. Advisory electrical circuits shown in the AV System drawings are for reference only in depicting the number of electrical circuits needed for operation of these systems.

F. Advisory datacomm circuits shown in the AV System drawings associated with the building data network are for reference only in depicting the number of network drop locations needed for operation of these systems.

01 Datacomm circuits associated with the dedicated AV-NET data network are wholly within the AV Contractor's scope of work, as specified in this Section and shown in the accompanying drawings.

G. Broadband signal feeds.

H. Satellite signal feeds and equipment.

PART 2 - PRODUCTS

2.1 GENERAL

A. All items shall be new and unused.

B. The following sections specifically list the acceptable equipment types and items for this project. Where quantities are not noted, they may be obtained from the drawings. In the event of a discrepancy between the specifications and the drawings, the greater quantity or better quality shall be furnished.

C. Refer to Part 1.5 SUBSTITUTIONS of this Specification Section.

2.2 WIRE & CABLE

A. All wire and cables shall be new and unused.

B. Wire not installed in equipment racks, not portable, or not installed in conduit shall be fire-rated and meet all applicable codes. Plenum-rated cable can only be used, if at all, in locations specified in the associated AV-series drawings. The systems contained in the system package are designed around standard PVC jacketed cable and EMT conduit.

C. Any and all exposed exterior cabling shall be UV rated.

D. Furnish and install the following, in quantities and lengths as required. Equivalent cable from other manufacturers may be considered.

01 Voice coil loudspeakers:
02 High frequency devices (bi/tri-amped systems only): West Penn 226 14AWG twisted pair.
03 Mid frequency devices and speaker monitor circuits (bi/tri-amped systems only): West Penn 227 12AWG twisted pair.
04 Low frequency and Full-Range devices: West Penn HA210 10AWG twisted pair.

E. Constant voltage (70.7-volt) loudspeaker cable:

01 Runs of less than 200 feet: West Penn 225 stranded 16AWG jacketed twisted pair.
02 Runs of 200' to 300': West Penn 226 stranded 14AWG jacketed twisted pair.
03 Runs of 300' to 500': West Penn 227 stranded 12AWG jacketed twisted pair.
04 Runs of 500' or more: West Penn HA210 stranded 10AWG jacketed twisted pair.

F. Audio Cable:

01 Microphone-level audio cable (installed in conduit, not portable): West Penn Wire 452 stranded 22AWG twisted pair with foil shield.
02 Line-level audio cable and all inter-rack audio cable: West Penn Wire 452 stranded 22AWG jacketed twisted pair with foil shield.
03 Exterior and below-grade Microphone and Line level cable: West Penn AQ293 stranded 18AWG twisted pair with foil shield.

G. Production Intercom cable (installed in conduit, not portable):

01 1-Channel: West Penn 293 stranded 18AWG twisted pair with foil shield.
02 2-Channel: West Penn D440 2-pair stranded 18AWG twisted pair with individual foil shield per pair.
03 4-Channel: West Penn D442 4-pair stranded 18AWG twisted pair with individual foil shield per pair.
04 Outdoor Production Intercom Cable (exposed directly to sunlight/weather or installed in conduit below grade): West Penn AQ293 stranded 18AWG twisted pair with foil shield.

H. Wireless microphone and RF Assistive Listening System antenna cable:

01 For runs less than 50 feet: Belden 9310, 50-ohm RG-58A/U coaxial cable with appropriate connectors.
02 For runs that exceed 50 feet: Belden 9914, 50-ohm RG-8A/U type coaxial cable with appropriate connectors.

I. Data cable (copper) for networked Audiovisual systems:

01 Installed Data cable: Panduit PUR6AV04*-G 23AWG Cat6a UTP, or approved equal conforming to project standard. * = color.
02 Data Patch cables: Panduit UTP28X*^ series 28AWG Cat6a UTP patch cables, or approved equal conforming to project standard. Provide in lengths required for applicable devices. * = length, ^ = color.

J. Fiber-Optic Cable for networked Audiovisual systems:

01 Panduit Opti-Core FOIRZ02Y 50µm OM4 2-strand Multimode Duplex Fiber Cable.

K. Other equipment control cables shall be stranded wire, appropriately shielded, of gauge and number of conductors required by the manufacturer for proper operation of the system or equipment item furnished.

L. Wire and cable for all other devices shall be supplied in accordance with the recommendations of the device manufacturer and the National Electrical Code.

2.3 JACKS, CONNECTORS, AND WALL PLATES

A. All plate-mounted connectors shall be ground-insulated from the plates on which they are mounted.

B. Floor-mounted jacks, unless noted otherwise, shall be installed in floor boxes. The interior plates shall be anodized black. Nomenclature shall be engraved into the interior plate of each floor box with 1/8" block letters filled with white paint. Coordinate floor box insert connector plates with actual floor boxes provided.

C. For non-standard custom panels, connectors shall be installed on 1/8" thick black anodized aluminum or brushed stainless steel panels. Nomenclature shall be engraved into the plate with 1/8" block letters filled with contrasting paint color. Coordinate final finish selection with Architect prior to Shop Drawing submittals.

D. All other jacks shall be installed on standard brushed stainless steel finish plates. Nomenclature shall be engraved into the plate with 1/8" block letters filled with black paint.

E. All AV signal circuit locations shall be numbered logically and consecutively for each circuit/signal type, starting from one (1).

F. All plate-mounted jacks at exterior locations shall be provided with captive sealing covers.

G. Unless otherwise specified, all jacks and connectors for the AV Systems shall be as follows, or approved equal:

01 Audio connectors:
- a. Microphone and line-level input jacks (XLR type): Neutrik NC3FD-L-B-1 3-pin female XLR panel-mount jacks with gold-plated contacts.
- b. Audio output jacks (XLR type): Neutrik NC3MD-L-B-1 3-pin male XLR panel-mount jacks with gold-plated contacts.
- c. Production Intercom chassis mounted connectors: Neutrik NC6MSD-L-1 6-pin XLR Male conforming to Switchcraft pin configuration, or approved equal by Switchcraft.
- d. Female cable-end audio connectors: Neutrik NC3FX-B 3-pin female XLR connectors with gold-plated contacts.
- e. Male cable-end audio connectors: Neutrik NC3MX-B 3-pin male XLR connectors with gold-plated contacts.

02 Video and RF connectors:

a. BNC chassis mounted connector (75-Ohm): Neutrik NBB75DFIX Isolated UHD/4K BNC Bulkhead Jack.
b. BNC chassis mounted connector (50-Ohm): Amphenol Connex 112443 BNC Bulkhead Jack.
c. BNC cable mounted connector (75-ohm): Kings 2065-10-9 3G-SDI (SMPTE 424M) crimp cable connector.

03 Loudspeaker connectors:
a. Chassis mounted speaker connectors: Neutrik NL4MP 4-pole locking jack, or approved equal.
b. Cable mounted speaker connectors: Neutrik NL4FC 4-pole locking plug, or approved equal.

04 Network Data connectors:
a. CAT6A chassis mounted connector: Neutrik NE8FDX-Y6-B CAT6A Shielded Bulkhead Jack, Black with rear IDC terminations.
b. CAT6A chassis mounted connector (IP65 Rated): Neutrik NE8FDX-Y6-W CAT6A Shielded Bulkhead Jack, Black with rear IDC terminations, and integrated sealing cover. These devices are associated with any configuration at a non-conditioned or exterior location.
c. Data connectors for Extron DTP systems: Extron XTP DTP 24 PLUG shielded RJ-45 plug. Employ these connectors for Extron DTP devices only.
d. CAT6A cable connectors: Panduit FP6X88MTG Cat6a straight field term plug, or approved equal.

05 Fiber optic connectors:
a. Field-terminated fiber optic connectors shall not be accepted. Contractor shall fusion splice factory terminated duplex LC pigtails or patch cords of appropriate mode and wavelength to installed fiber optic cabling associated with AV System equipment.

06 Power Sequencing Remote Low-Voltage connectors:
a. Provide connectors for use with remote connections for power sequencing switch sets and standalone sequenced power modules. Connectors shall be in an industry standard form factor with an uncommon pin configuration to alleviate any mis-connection from standard audio, production intercom, or DMX systems.
b. Chassis-mount 4-pin XLR male: Neutrik NC4MD-L-B-1 4-pole male receptacle with gold contacts and black metal housing.
c. Chassis-mount 4-pin XLR female: Neutrik NC4FD-L-B-1 4-pole female receptacle with gold contacts and black metal housing.
d. Cable-mount 4-pin XLR male: Neutrik NC4MX-B 4-pole male cable connector with black metal housing and gold contacts.
e. Cable-mount 4-pin XLR female: Neutrik NC4FX-B 4-pole female cable connector with black metal housing and gold contacts.

H. Furnish and install the required number of jacks and connectors as indicated on the drawings.

2.4 EQUIPMENT RACKS

A. Furnish equipment racks for use in housing Audiovisual equipment including, but not limited to, power amplifiers, signal processors, input/output devices, playback equipment, intercom equipment, etc., and ancillary devices necessary to the operation of the system. Provide a ¼" (nominal) non-conductive industrial-grade black rubber mat under each floor-mounted cabinet trimmed to the footprint of the cabinet for isolation from building structure.

B. Each equipment rack shall include a locking front and rear doors, side panels, and top and bottom panels unless otherwise noted.

C. Equipment rack colors shall be flat black.

D. Heat-producing components shall be mounted with one RU blank panel installed between units, or as the manufacturer recommends. Fill all other unused portions of rack front sections with matching blank panels

E. Furnish (5) sets of spare keys for each equipment rack.

F. All mounting screws shall be theft resistant.

G. Install the required number of units, of sufficient size to accommodate the equipment specified, at the locations indicated in the drawings.

H. At locations / systems with power sequencing, configure so that power amplifiers and active loudspeakers are the last to turn on in system power-up sequence and first to turn off in power-down sequence.

I. Furnish and install the following, or approved equal:

01 Wall Mount Equipment Rack at Black Box Control Booth (WR): Middle Atlantic Products DWR-35-26, to include FD-35 locking solid front door. (Qty: as shown)

02 Portable Mixer Rack at Black Box: Grundorf T8-TLR1224-TM7B mixer rack rack for specified digital mixing console, to include RRR rear rack rail and TLR8-24-LC2B Caster Base options. (Qty: 1 ea.)

03 Single-circuit Power Sequencing at Black Box:
   a. Middle Atlantic Products PDS-620R single-circuit sequenced power distribution unit. Configure outlet sequence order so that amplifiers are turned on last and powered down first. Interface control contacts with AV control system for system power control via touch control screen. (Qty: 1 ea.)

04 Rackmount Power Strips with Retractable Front Light: Radial Engineering POWER-2. (Qty: as shown)

05 Brush Grommet Panel: Middle Atlantic BR1. (Qty: as shown)

06 Rack Recessing Panels:
   a. Middle Atlantic RR2-3RCN Rack Rail Recessor, 2 rack units (pair), 3” deep. (Qty: as shown)
   b. Middle Atlantic CN1032-50 Cage Nuts for recessors (50-count). (Qty: as required)

07 Rack shelves:
   a. Middle Atlantic U1 1RU rack shelf. (Qty: as shown)

08 Rack Blank Panels:
   a. Middle Atlantic BL1 1RU black brushed and anodized blank panel. (Qty: as shown)
   b. Middle Atlantic BL2 2RU black brushed and anodized blank panel. (Qty: as shown)

09 Rack drawers:
   a. Middle Atlantic D3LK 3RU rack drawer with lock. (Qty: as shown)

10 Sliding Rack Shelf: Middle Atlantic SS Sliding Rack Shelf. (Qty: as shown)

2.5 DIGITAL SIGNAL PROCESSOR

A. The audio processing shall be in the digital domain following the input source and shall remain until power amplification is required.

B. All network connections to be coordinated with the Owner's network representatives. The Owner's IT department to set-up static IP addresses in association with the Installer.

C. Provide all data interconnection cabling as shown.

D. System programmer shall be QSys Level 2 certified or otherwise advanced manufacturer-certified for programming any respective approved substitute DSP product/system.

E. Include all licensing for DSP plug-ins and Dante™ routing by software, as required.

F. The system processor shall provide up to 64 x 64 networked audio channels individually configurable as either Q-LAN or AES67 formatted networked audio. Additionally, the system processor shall include 8 x 8 Software-based Dante network audio channels and is licensable for up to 32 x 32 Software-based Dante capacity. Software-based Dante channels used subtract from the overall 64 x 64 network audio capacity.

G. The system processor shall support an 8-channel total analog I/O capacity and shall be presented as 8 Flex Channel I/O which shall be software definable as analog inputs or outputs in single channel increments in any combination ratio.

H. The system processor shall have the following front panel controls and indicators: Unit ID button and Power On blue LED. Device Status, monitoring, and logging shall be provided by a standard web interface. On the rear panel, the system processor shall have two 3-pin RS232 Euro Block Connectors, 8 GPI general purpose control inputs on a 10-pin Euro Block Connector, 8 GPO general purpose control outputs on a 10-pin Euro Block Connector, USB C and B connectors to support AV bridging with QSC Q-SYS cameras and/or present itself as one or more multi-channel USB audio interfaces. Q-SYS Network: LAN A RJ45 1000 Mbps only, LAN B: RJ45 1000 Mbps only.

I. The system processor shall operate from a single design, which can be comprised of components, wiring, links, text, and graphics on a single or multiple schematic pages. Designs shall include any of the following DSP function blocks, test and measurement components, control components, and layout components: Acoustic Echo Cancellers, SIP Softphone instances, USB Audio host and device blocks, Audio Players, Audio Streaming components, Crossfaders, Crossovers, Delay components, Auto Gain control elements, Compressors, Gates, Duckers, Expanders, Ambient Noise Compensators, Limiters, Gain blocks, Graphic Equalizers, Parametric Equalizers, FIR Filters, All-Pass Filters, Band-Pass Filters, Band-Stop Filters, High-Pass Filters, Low-Pass Filters, FIR High-Pass filters, FIR Low-Pass Filters, Dual-Shelf Equalizers, Notch Filters, Meters, Matrix Mixers, Gain-Sharing Automatic Mixers, Gated Automatic Mixers, Signal Routers, Public Address Routers, Room Combiners, Signal Presence Meters, Tone Generators, Tone and Noise Generators, Dual Trace FFT Measurement Modules, Real Time Analyzers, Signal Injectors, and Signal Probes.

J. The system processor shall support custom user control interfaces on either proprietary touch screen controllers, network computers utilizing a control application, iOS devices, or any device with a standard web browser. Custom control interfaces shall be capable of having multiple user-selectable pages with different controls on each. All GUI's shall be submitted to the consultant for approval prior to programming and finalization.

K. Furnish and install the following as indicated in the accompanying Audiovisual drawings, or approved equal:

01 Digital Signal Processor (DSP): QSC Q-Sys CORE 8-FLEX. (Qty: as shown)
02 Type “C” Touch Control Panel: QSC TSC-70-G3 7” touch control panel, to include mounting bracket. (Qty: as shown)
03 Type “BT” Bluetooth / Multi-I/O wall plate: Attero Tech by QSC unD6IO-BT Dante Networked Audio Wall Plate, to include matching 2-gang decora cover plate. (Qty: as shown)
04 Network Switch: Aruba Instant On JL684B 1930-series 24-Port switch with 24x 1G PoE+ RJ45 ports, 4x 1/10GbE SFP/SFP+ ports, 370W PoE+ power budget. (Qty: as shown)

L. Successful Contractor shall be responsible for programming each software configuration file for each system based on intended functionality shown, or implied, in the drawings. Each system shall be programmed so the default operating condition is auto-populated upon system power-up. Interface with the presentation and control system at each applicable space and program associated touch control panels for user control of all parameters necessary for successful control and operation of connected devices in each system. At locations where touch control screens are intended to be the mechanism by which system power is controlled, program touch control screens for this functionality, ensuring associated DSP and Network Switch devices are powered from non-switched, non-sequenced power outlets. Terminate and program fire alarm interface at each system. Each system shall be programmed to mute all program audio upon receipt of contact closure from the addressable fire alarm module, provided by fire alarm vendor, at each system location. Contractor shall provide a review copy of the programming file to the Consultant for review at the latest four (4) weeks prior to scheduled commissioning trip.

2.6 LOUDSPEAKERS

A. The drawings indicate the loudspeaker positions and aiming points for each loudspeaker.

B. Loudspeakers shall be mounted to the structure, at the positions and angles indicated relative to the aiming points. Suspend each component with commercial rigging hardware, in such a way as to facilitate minor angle adjustments. Safety factor shall be at least 5. Furnish rigging details during submittal process. Secure any loose hardware to prevent vibration and rattling. Orient each speaker at the location and angles indicated in the drawings. Make minor adjustments as required to provide even sound distribution.

C. Measure and record the impedance of each driver at the amplifier terminals. High frequency drivers shall be measured at 1000Hz; low frequency drivers shall be measured at 250Hz. Include the measurements in the final documentation.

D. For loudspeakers incorporating 70.7v transformers/autoformers, tap as indicated in the drawings.

E. Retain the services of a registered professional structural engineer licensed to practice in the State of project installation to develop mounting details, including attachment to the building structure. Structural information shall include design calculations and a copy of engineer’s certification.

F. Verify factory color option selection with Owner / Architect prior to product acquisition.

G. Furnish and install the following assemblies, or approved equal:

01 Type “S1” Loudspeaker: QSC E112 12” loudspeaker with 85° conical dispersion. To be supplied with E12YM yoke mount and TMB Pro-Burger PRBHC3/8B 2” pipe clamp for mounting at Black Box pipe grid. Provide 10-foot “Speakon” portable speaker cable for each unit supplied. (Qty: as shown)

2.7 CEILING-RECESSED LOUDSPEAKER ASSEMBLIES

A. Furnish ceiling-recessed loudspeakers at the locations noted on the drawings.

B. Ceiling-recessed speakers shall be installed in a recessed enclosure, whether it be a separate back can or part of an integrated loudspeaker assembly. Furnish braces designed to provide additional support to the weight of the speaker and prevent tile sag. Coordinate exact locations with the Owner. Connect the loudspeakers as indicated in the drawings. Furnish enclosures/back cans to Division 26 for installation if/where required.

C. Verify factory loudspeaker color with Architect prior to product acquisition. Baffles shall be painted a color selected by the Arch./Owner. Coordinate with the Architect regarding color selection.

D. Tap the transformers as indicated in the drawings. Measure and record the impedance at 1000Hz of each home run at the amplifier terminals. Include the measurements in the final documentation.

E. Furnish and install the following, or approved equal:

01 Type “S2”: Electrovoice EVID C6.2 6.5” 2-way 70v recessed ceiling speaker assembly. (Qty: as shown)

2.8 POWER AMPLIFIERS

A. Provide power amplifiers for use in amplifying audio signals for distribution to the loudspeakers.

B. Each power amplifier shall have an analog input connector which is either a screw-type barrier strip or XLR type. Networked amplifiers shall incorporate RJ-45 data jacks for network signal and/or control connectivity. Output connectors shall be either barrier strip or Neutrik Speakon connectors. Other types of connectors shall not be accepted. All power amplifiers shall have detented stepping input level controls. Install the units in the main equipment racks and connect as indicated in the drawings.

C. Provide (1) one amplifier channel for each loudspeaker home run. Size amplifier based on total power consumption of each home run. Locate amplifiers at sound equipment racks associated with each loudspeaker home run / zone.

D. Furnish and install the following, or approved equal:

01 8-channel network amplifiers compatible with specified DSP, 1,000 watts/ch max. @ 8-Ohms and 70V: QSC CX-Q-4K8. (Qty: as shown)

2.9 VOLUME CONTROLS

A. Furnish wall-mounted volume controls at locations indicated for use in controlling loudspeaker levels within each respective area.

B. Size each device per total speaker load at each location / zone.

C. Furnish and install the following, or approved equal:

01 Type “V”: Lowell Manufacturing **LVC-* 1-gang volume control (**=power rating, *=color). (Qty: as shown)

2.10 PLAYBACK, RECORDING, AND INTERFACE DEVICES

A. Furnish audio devices to facilitate the use of pre-recorded content or portable media. Connect as indicated on the drawings.

B. Furnish and install the following, or approved equal:

01 CD/Media Player with Bluetooth, Aux, and USB inputs: Tascam CD-400U. (Qty: as shown)

2.11 DIGITAL MIXING CONSOLE

A. Furnish a mixing console for use in processing and routing microphone and line level sources.

B. Provide remote mixing capabilities with wireless tablet via the AV Network Wi-Fi.

C. The mixing console shall have the I/O specified, and be configured on the built-in Dante network.

D. Configure the console prior to commissioning and provide configuration file to consultant for review.

E. Configure all Dante enabled devices, including wireless microphones and audio recorders, on the console.

F. Configure all routing of signal from console to DSP, via Dante into the Q-SYS platform.

G. Furnish and install the following at the Black Box, or approved equal:

01 Digital Mixing Console: 72 mix channels with 16 local mic/line inputs, 12+4 fader configuration, 48 output busses, and integrated Dante digital audio: Yamaha DM7C. To be supplied with RK1 rackmount kit. Mount at Portable Mixer Rack. (Qty: 1 ea.)
02 Headphones: Audio Technica ATH-M50x. (Qty: 1 ea.)

2.12 WIRELESS MICROPHONE SYSTEMS

A. Diversity UHF wireless microphone systems shall be used in this facility.

B. Operating frequency shall be as high as possible, and shall be selected so as to avoid interference.

C. The Contractor shall perform a Wireless Frequency Scan in order to determine the proper frequency selection for each venue.

D. Units are to be provided with rackmount kits, in the configurations shown in the accompanying drawings, and installed in equipment racks, whether fixed or portable racks, for use at each applicable venue.

E. Each system shall be provided on different frequencies so that they can be used simultaneously.

F. Furnish and install the following wireless systems and accessories, or approved equal, for use at the Black Box:

01 Shure QLXD124/85 Combination System with QLXD4 digital wireless receiver, QLXD2/SM58 handheld transmitter, and QLXD1 bodypack transmitter. (Qty: 2 ea.). Mount supplied ½-wave antennas at portable mixer rack rear rack panel.
02 Countryman E6 I-series* (* = B, T, C, LT) standard sensitivity omnidirectional earset microphone with TA4F connector. Verify with the Owner's representative for factory color selection – Black, Tan, Cocoa, or Light Tan. (Qty: 2 ea.)
03 Shure UA221 passive antenna splitter kit. (Qty: as required)
04 Shure SB900B Lithium-Ion rechargeable batteries. (Qty: 4 ea.)
05 Shure SBC200-US 2-Bay battery charging station, to include power supply. (Qty: 2 ea.)

2.13 PRODUCTION INTERCOM SYSTEM

A. Provide wired and wireless production intercom systems for use in voice communication and personnel coordination during events where indicated in the drawings.

B. Furnish intercom power supplies in sufficient quantities to accommodate all intercom devices per manufacturer's specifications and recommendations for each system.

C. Refer to associated Audiovisual drawing package for all device, outlet, and equipment locations.

D. Furnish and install the following, or approved equal, associated with the Black Box:

01 Clear-Com PS-702 2-channel power supply. (Qty: 1 ea.)
02 Clear-Com RS-702 2-channel wired intercom belt pack. (Qty: 6 ea.)
03 Clear-Com CC-300 single muff intercom headset w/ flexible dynamic boom mic. (Qty: 6 ea.)
04 Clear-Com IC-25-2P 25-foot 6-pin XLR-F to XLR-M intercom cable, or approved equal from Whirlwind conforming to SwitchCraft 6-pin configuration. (Qty: 6 ea.)

2.14 ASSISTIVE LISTENING SYSTEMS

A. Furnish and install FM wireless assistive listening systems for use by the hearing-impaired. The assistive listening system (ALS) shall be capable of broadcasting on 57 channels and be frequency agile.

B. The receiver shall have a programmable multi-function Listen button that can be tuned for the venues desired channels and electronically lock out any unused channels. The receiver shall have a signal-to-noise ratio of 70 dB or greater and shall have an audio frequency response of 50 Hz - 15 kHz (±3 dB). The device shall employ a unique DSP SQTM noise reduction technology. The unit shall have a programmable squelch circuit. The unit shall incorporate a multi-functional display that indicates battery status,

inventory number and channel. The device shall have the option of being lanyard or belt clip worn and the lanyard shall have the option of an integrated neck loop. The device shall have a USB connector used for inventory control, set up, charging and firmware upgrades. The device shall incorporate automatic battery charging circuitry and use a non-proprietary lithium ion battery. The device shall have additional charging contacts to allow multiply charging options.

C. Supplemental transmission is provided via an assistive listening WiFi server distributed through the building WiFi wireless network. Personal reception is accomplished with a user-installed smartphone app, facilitating wireless connectivity to Bluetooth-enabled hearing aids.

D. Furnish and install the following, or approved equal:

01 Listen Technologies LS-55-216 iDSP Prime Level 3 Stationary RF System (216 MHz), to include (1) transmitter with rackmount kit, (4) rechargeable personal receivers, (4) intelligent Earphone/Neckloop lanyards, (4) universal ear speakers, 12-unit charging tray, ALS notification signage kit, and accessories. (Qty: 1 complete system)
02 Listen Technologies LA-124 90° Helical Antenna (216 MHz). Remote mount at "AL" location. (Qty: 1 ea.)

2.15 MICROPHONES, STANDS, CABLE, AND DIRECT BOXES

A. Furnish microphones, stands, cables, and Direct Boxes for flexible use throughout the facility.

B. Each microphone shall be equipped with its own cable, with Neutrik connectors installed on each end.

C. Furnish the following:

01 Shure SM58-LC Cardioid Dynamic Vocal Microphone. (Qty: 4 ea.)
02 Atlas Sound TB3664 tripod microphone stand with boom, black. (Qty: 4 ea.)
03 Whirlwind MKQ50NP-BLACK 50-foot microphone cable. (Qty: 12 ea.)
04 Whirlwind L15 Leader 15-foot instrument cable. (Qty: 2 ea.)
05 Radial Engineering JDI passive direct box with Jensen transformer. (Qty: 1 ea.)
06 Radial Engineering PRO-AV2 passive stereo multimedia direct box. (Qty: 1 ea.)

PART 3 - EXECUTION

3.1 INSTALLATION

A. Furnish components, racks, wire, cabinetry, connectors, materials, parts, equipment and labor necessary for the complete installation of the systems, in full accordance with the recommendations of the equipment manufacturers and the requirements of the drawings and specifications.

B. Installation shall follow standard broadcast wiring and installation practice, and shall meet or exceed industry standards for such work, with particular attention given to any installation instructions in Part 2 of these Specifications.

C. Equipment shall be held firmly in place with proper types of mounting hardware. All equipment affixed to the building structure must be self-supporting with a safety factor

of at least three. All equipment shall be installed so as to provide reasonable safety to the operator.

D. All equipment shall be designed and rated for continuous operation and shall be UL listed, or manufactured to UL standards.

E. Observe proper circuit polarity and loudspeaker wiring polarity. No cables shall be wired with a polarity reversal between connectors with respect to either end. Special care shall be taken when wiring microphone cables, to ensure that constant polarity is maintained. Balanced audio connectors shall be wired as follows:

WIRE	CONNECTOR	SIGNAL
BLACK	PIN#3 or RING	LOW or
RED or WHITE	PIN#2 or TIP	HIGH or
BARE	PIN#1 or SHIELD	GROUND

F. Provide all audio circuits balanced and floating, except as noted in the Specifications or directed by the Consultant at the time of final equalization and testing. Shields of audio cables shall be grounded at one end only, at the inputs of the various equipment items in the system.

G. Route cables and wiring within equipment racks and cabinetry according to function, separating wires of different signal levels (video, microphone level, line level, amplifier output, 120VAC, intercom, control, etc.) by as much physical distance as possible. Neatly arrange and bundle all cables loosely with plastic cable ties. Cables and wires shall be continuous lengths without splices.

H. All system wire, except spare wire, after being cut and stripped, shall have the wire strands twisted back to their original lay and be terminated by approved soldered or mechanical means. No unterminated wire ends will be accepted. Heatshrink type tubing shall be used to insulate and dress the ends of all wire and cables. Include a separate tube for the ground or drain wire.

I. All cables in conduits shall be insulated from each other and from the conduit the entire length and shall not be spliced. All cables and wires are to be continuous lengths without splices.

J. All solder joints and terminations shall be made with resin-core silver solder.

K. Temperature regulated soldering irons rated at least 60 watts shall be used for all soldering work. No soldering guns or temperature unregulated irons shall be used on the job site.

L. Mechanical connections shall be made using approved connectors of the correct size and type for the connection. Wire nuts will not be accepted.

M. Each mechanical connector shall be attached using the proper size controlled-duty-cycle ratcheting crimp tool which has been approved by the manufacturer of the connectors. Conventional non-ratcheting type crimping tools are unacceptable, and shall not be used on the job site.

N. Label all wires in racks and console as to destination and purpose. Clearly and permanently label all jacks, controls, and connections, at the front and back of the rack,

with permanent engraved laminated plastic labels or by engraving and filling mounting plates, unless otherwise noted. Attach laminated plastic labels with contact cement. Embossed or printed label tape, and press-on or lift-off lettering systems will not be accepted. All labeling shall be completed prior to final system inspection.

3.2 SOUND SYSTEMS FINAL TESTING AND EQUALIZATION

A. The completed AV Systems shall be physically inspected by the Consultant to assure that all equipment is installed in a neat and professional manner, and in accordance with this Section. The AV Systems shall be tested by the Consultant, BAi, Austin, TX. Contact BAi at 512-476-3464 at least 4 weeks in advance of requested check-out dates for scheduling. Provide jobsite photos, confirming substantial completion of the AV Systems, to the Consultant for review when requesting check-out dates.

B. The testing and equalization work shall be performed after the installation work has been completed, but prior to any use of the system.

C. During the testing and equalization work, the Installer shall have on the job site one (1) competent technician who is familiar with the project, and who will be prepared to stay as long as his services are needed. It is estimated that approximately eight (8) hours will be required for this work.

D. The process of equalizing and testing the system may necessitate moving and adjusting certain loudspeakers. Adjustments shall be performed without claim for additional payment.

E. Coordinate as necessary to ensure a totally quiet room during the AV Systems testing and balancing period.

F. Prior to requesting systems testing, verify the following:

01 All systems are in first-class working condition and free of short circuits, ground loops, parasitic oscillations, excessive system noise beyond published specifications of the equipment, hum, RF interference, or instability of any form.
02 All specified equipment is on the job site for proper accounting.
03 All loudspeaker circuits have been tested, are connected to the proper crossover frequency, and are in perfect working order. Furnish impedance measurements of each circuit prior to final tests.
04 All equipment controls are labeled, even if unused. If permanent labels cannot be furnished prior to system inspection, temporarily label every control as to its function with write-on tape. Supply labels or markers suitable for indicating knob settings after equalization is performed.
05 Operation manuals for every equipment item furnished are on hand at the job site.
06 Installer shall provide all signal processing software loaded on a portable PC and ready for use at time of testing. Installer shall provide a calibrated RTA and microphone, and pink noise generator at time of testing.

G. Should the performance testing show that the Installer has not properly completed the systems, the Installer shall make all necessary corrections or adjustments and a second demonstration shall be arranged at the Installer's expense.

H. The final acceptance of the system by the Owner will be based upon the report of the Consultant following inspection, testing, and demonstration. A list of items in need of

completion or correction shall be generated by the Consultant, which must be corrected by the Installer before final acceptance will be granted.

3.3 SOUND SYSTEM PERFORMANCE

A. After equalization and testing, the sound system shall meet or exceed the following specifications:

01 System shall be free of short circuits, ground loops, parasitic oscillation, excessive system noise, hum, RF interference, and instability of any form.

02 Maximum SPL with band-limited pink noise input to the system shall be:

a. Auditorium: Maximum SPL with band-limited pink noise / program material input to the system shall be 93 dB before audible distortion occurs, spatial variation +/- 3dB at 4kHz, frequency response uniform to +/- 2 dB, 32 Hz to 16 kHz.

3.4 OWNER TRAINING AND FAMILIARIZATION

A. The Installer shall furnish the Owner's representatives with training necessary to properly operate the systems. Demonstrate in detail all functions of the systems. Provide a minimum of eight (8) hours of instruction and familiarization for this purpose. These training sessions shall be videotaped by the Installer and copies provided to the Owner with the as-built documentation.

B. The Installer shall attend one scheduled event, as selected by the Owner, to assist and troubleshoot, as necessary, in initial user operation of these systems.

C. The training phase shall be accompanied by complete as-built documentation and the custom technical systems operation manual, as described in Part 1.09 of this Specification Section.

END OF SECTION

SECTION 27 41 16.20

LOCAL SOUND REINFORCEMENT SYSTEMS

PART 1 – GENERAL

1.1 RELATED WORK

A. The following sections shall associate with this specification as applicable.
   1. General Conditions
   2. Supplementary Conditions
   3. Division 1
   4. Division 26 in its entirety.
   5. Division 27 in its entirety.
   6. Division 28 in its entirety.

1.2 DESCRIPTION

A. Summary of Work:
   1. Provide all equipment specified well as all miscellaneous parts and materials required for the proper, complete, and functional Video and/or Sound Distribution System at the following Venues:
      a. Athletic Fields
         1) Softball Pressbox
         2) Baseball Pressbox
         3) Football Pressbox
   2. All applicable equipment shall bear the UL label.
   3. Governing Codes and Conflicts: If the requirements of these specifications or the Project Drawings exceed those of the governing codes and regulations, then the requirements of these specifications and the Drawings shall govern. However, nothing in the Drawings or Specifications shall be construed to permit work not conforming to all governing codes, regulations, and manufacturer installation requirements.
   4. Locate equipment to accommodate millwork, fixtures, marker boards and other room equipment at no additional cost to the owner.
   5. Plenum rated cable may be used as an option at the contractor's discretion. Wherever cabling is run exposed, conduit shall be used to cover and protect wiring.
   6. These documents are conceptual in nature. It shall be the responsibility of the approved installer to furnish a complete and functional system, including the items shown on the drawings, in the specifications, and items not designated in either. The installer's shop drawings and product data submittals shall represent a complete system and documents accepted do not relieve the installer from being required to provide any materials, equipment, or labor to furnish a complete and functional system as recognized by the Project's Technology Consultant and the Owner.

1.3 QUALITY ASSURANCE

A. Installer Qualifications:
   1. The contractor providing and installing the integrated audiovisual systems and associated infrastructure shall be an authorized dealer of the specified projector manufacturer and be capable of providing the manufacturer's maximum available product warranty.
   2. All individuals installing the audio-video system must be employees of the authorized dealer and at least 75% of the installing staff shall have undergone a

training class given by the manufacturer. Current certification indicating the successful completion of the training course shall be available upon request at the project and submitted in the contractor's product submittals.

3. The proposing contractor and the installing contractor must be the same company. No subcontractor to the proposing audio-video contractor will be allowed for any portion of the audio-video scope of work.
4. The System Installer shall meet all applicable regulations of the State and Department of Labor insofar as they apply to this type of system. The bidder shall be a firm normally employed in the audio-video industry and shall provide a reference list of ten (10) projects of equivalent size or larger and contact names confirming successful completion of projection system installations.
5. The bidder shall have an authorized service center, within 75-miles of the project's location, for the brand of equipment that is submitted for bid. The Owner, Architect, and Consultant reserves the right to perform an onsite inspection as they deem necessary.
6. The bidder must produce a letter from the manufacturer guaranteeing the delivery of all the equipment outlined in the specification herein.
7. The bidder shall have a full-time local service personnel capable of servicing the projector system described herein.

B. Pre-Construction Meeting:
   1. The successful Contractor shall attend a mandatory pre-construction meeting with individuals deemed necessary by the Owner's representative prior to the start of the work.
   2. The contractor shall provide a mockup of the complete integrated audiovisual system solution for each of the typical spaces below before implanting the installation in multiple like rooms. Mockup shall include all products listed in part 2 of this specification. Coordinate with G.C., Architect, Consultant, and Owner for scheduling and location of mockup.
   3. All proposing contractors must have ability to demonstrate a/v system being proposed and provide owner with completely installed system to evaluate performance and operation.

C. Acceptance: The Owner's representative reserves the right to reject all, or a portion of the work performed, either on technical or aesthetic grounds.

D. Warranty:
   1. The selected system installer shall be factory authorized service center and shall provide an end-to-end performance warranty of not less than one (1) year. The proposer shall provide current certification documentation. The performance warranty shall be issued by the manufacturer and shall warrant that video projection system projectors have been tested to the district's approval. This end-to-end warranty shall cover the labor associated with removing/reinstalling any associated hardware or equipment as well as the replacement of all defective equipment or hardware.
   2. The bidder shall also submit with the materials mentioned in section 1.5 submittals of this specification a written explanation outlining the terms and conditions of product warranty of all parts and service of the integrated a/v solutions.

1.4 REGULATORY REQUIREMENTS

A. Standards: All work shall be performed in accordance with the latest revisions of the following standards and codes:
   1. Latest Local Codes and Amendments
   2. National Electrical Code, current version

B. Other References:
   1. TIA/EIA-568-A Commercial Building Telecommunications Wiring Standard
   2. EIA/TIA-569 Commercial Building Standard for Telecommunication Pathways and Spaces.
   3. TIA/EIA-606 The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
   4. TIA/EIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications.
   5. EIA/TIA 455-A Standard Test Procedure for Fiber Optic Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices and Other Fiber Optic Components.
   6. TIA/EIA TSB 67 Transmission Performance Specification for Field Testing of Unshielded Twisted-Pair Cabling Systems.
   7. TIA/EIA TSB 72 Centralized Optical Fiber Cabling Guidelines
   8. ISO/IEC 1180 Generic Cabling Standard
   9. EN 50173 Generic Cabling Standards for Customer Premises
   10. ANSI/EIA/TIA 526-14 Optical Power Loss Measurements of Installed Multimode Fiber Cable Plan.

C. Governing Codes and Conflicts: If the requirements of these specifications or the Project Drawings exceed those of the governing codes and regulations, then the requirements of these specifications and the Drawings shall govern. However, nothing in the Drawings or Specifications shall be construed to permit work not conforming to all governing codes and regulations.

1.5 ABBREVIATIONS

A. The following abbreviations are used in this document:
   1. AV-*# Audiovisual input station / Presentation Station (Reference drawing legend) CMP Ceiling Mounted Projector LCD or LED Flat panel screen/monitor

1.6 SUBMITTALS

A. Project Initiation: Within fourteen (14) days of Notice to Proceed, the projection system installer shall furnish the following in a single consolidated submittal:
   1. Permits: The Contractor shall obtain all required permits and provide copies to the Owner/Architect/Engineer.
   2. Product Literature: Complete manufacturer’s product literature for all, speakers, amplifiers, cable, cross-connect blocks, cable supports, cable labels, outlet devices, and other products to be used in the installation. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner/Designer) and the manufacturer’s supporting documentation demonstrating compatibility with other related products shall be included.
   3. Construction Schedule: A time-scaled Construction Schedule, using PERT/CPM, indicating general project deadlines and specific dates relating to the installation of the cable distribution system.
   4. Testing: Proposed Contractor test result forms, and a list of instrumentation to be used for systems testing.
   5. The contractor shall provide a letter from the manufacturer stating that the dealer is an authorized service center.
   6. The resume and contact information of the full-time service personnel responsible for the installed projection system.
   7. Specification Compliance: A letter shall be provided stating, by section and subsection, that the installer complies with the ENTIRE specification section. If the installer intends to deviate from any portion of the specifications, a detailed

explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been accepted by the project's technology consultant.

8. Certifications: The contractor shall submit all of the following certifications and the certifications must contain dates which are valid from the date of proposal and not expirer any sooner than 12 months after substantial completion of the project.
    a. AMX authorized dealer certification
    b. Installer training certification: 1) Provide specification with line-by-line acknowledgement of compliance.

B. Shop Drawings: Submit the following items, for Owner review and approval, within twenty-eight (28) days of notice to proceed:
    1. Proposed wiring and connectivity diagram of the proposed projection system including all faceplates and sound reinforcing equipment
    2. In addition to the wiring/connectivity diagram, the submitted drawings shall indicate the following, even if the following is expected to be provided by the project's electrical or general contractor:
        a. Location of wall penetrations (all penetrations shall be sleeved and contain protective bushings at both ends)
        b. Location of sleeved wall pass-thru
        c. Size of sleeve at each location installed
        d. Quantity of cable passing through each sleeve
        e. Location of drops in each room (quantity or labeling of drops are not required in the submittal plans. Labeling shall be provided in the closeout plans and quantities shall be as per the contract documents, addendums, and issued changes. Each drop shall be labeled for the type of outlet that it is)
        f. Conduit routing, size, quantity, and stub-up locations for all floor mounted outlets.
    3. Drawing Compliance: A letter shall be provided stating that the installer complies with the ENTIRE project drawing, including all general, keyed, and notes to contractor. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. NO DEVIATIONS SHALL BE ACCEPTABLE UNTIL THEY HAVE BEEN ACCEPTED BY THE PROJECT'S TECHNOLOGY CONSULTANT.

C. Project Completion: As a condition for project acceptance, the Contractor shall submit the following for review and approval:
    1. Samples: Complete manufacturer's product literature and samples (if requested) for all pre-approved substitutions to the recommended products made during the course of the Project.
    2. Inspection and Test Reports: During the course of the project, the Contractor shall maintain an adequate inspection system to ensure that the materials supplied, and the work performed conform to Contract requirements. The contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion.
    3. Operating and Maintenance Instructions: Operating and maintenance instructions for all devices within the system. These instructions shall reflect any changes made during the course of construction and shall be provided to the Owner for their use on disc or USB drive with the project name and description (2 copies).
    4. Provide schematic line diagram of system components as deployed in each installation.

PART 2 – PRODUCTS

2.1 GENERAL

All products listed in this section shall be provided and installed by the contractor unless otherwise noted below. The following list is not intended to be a complete list of required equipment or cables as the project is to be Turnkey and may require equipment beyond the depth of this list. It is the contractor's responsibility to ensure that they are providing a complete and functional system with their proposal.

A. Installation: The cabling shall be installed per requirements of the manufacturer and the Project Documents utilizing materials meeting all applicable TIA/EIA standards. The Contractor is responsible for providing all incidental and/or miscellaneous hardware not explicitly specified below as required for a complete and operational system.

B. Materials: Materials shall be as listed or shall be approved equivalent products of other manufacturers meeting the intent and quality level of the TIA/EIA specifications. All approved equivalent products will be published by addendum ten days prior to proposal for Architect / Engineer to review.

C. Testing: All installed cabling shall be tested 100% good after installation by the Contractor.

D. Ratings: All products shall be new and brought to the job site in the original manufacturer's packaging. Electrical components (including innerduct) shall bear the Underwriter's Laboratories label. All communications cable shall bear flammability testing ratings as follows:

CM Communications Cable
CMP Plenum Rated Communications Cable
CMR Riser-Rated Communications Cable

E. Initial Cable Inspection: The Contractor shall inspect all cable prior to installation to verify that it is identified properly on the reel identification label, that it is of the proper gauge, containing the correct number of pairs, etc. Note any buckling of the jacket that would indicate possible problems. Damaged cable or any other components failing to meet specifications shall not be used in the installation.

F. Cable Lubricants: Lubricants specifically designed for installing communications cable may be used to reduce pulling tension as necessary when pulling cable into conduit.

1. Approved Products
   a. Twisted-pair cable: Dyna-Blue
   b/ American Polywater

G. Fire Wall Sealant: Any penetration through firewalls (including those in sleeves) will be resealed with an Underwriter Laboratories (UL) approved sealant.

1. Approved Products
   a. 3M or
   b. Pre-approved equal

2.2 TRAINING

A. A minimum of eight hours for instruction in proper operation and routine maintenance of the system. Instruction shall cover all materials indicated in the Owner's operations manual.

B. Operational guidelines shall be given in written form in sufficient numbers so that all key personnel have operational instructions of programming; station use and special features. Copies of these instructions shall be provided for permanent record in the operations and maintenance manuals.

2.3 WARRANTY

A. One year from Date of Substantial Completion

2.4 PRODUCTS AND MATERIALS

A. Athletic Field P.A. System: replace existing systems
   1. Amplifier: QSC 4-channel PLD 4.2 or similar product
   2. Rack: Middle Atlantic DTRK-718 or similar product
   3. Mixer: Art MX622 or similar product
   4. Wireless Microphones: Two (2) Shure QLX/ULX wireless mics
   5. Exterior mounted speakers- JBL AWC 129 BK
      a. Mount speakers on front of press box: two speakers on each side, mounted horizontally one over the other. Speakers must be mounted to move left and right horizontally.
   6. Wall mounted equipment (in the knee space in center of press box)
      a. One Mic Jack Plate
      b. One L-R Aux input plate (2 RCA audio jacks)

B. Hearing Assist System – Provide hearing assist systems in areas are required by code. The hearing assist system is to consist of a FM transmitter with one antenna. The transmitter will broadcast in the FM band from 72.1 MHZ to 75.9 MHZ.
   1. Williams Sound PPA L157 system with PPAR35 receivers, one RPK005 rack mount kit and one ANT005 whip antenna
   2. Provide belt packs and mics in quantities required for space capacity as per ADA standards.

PART 3 – EXECUTION

3.1 GENERAL

A. Contractor is required to properly mount integrated A/V solutions and connect all ceiling video / audio cables to projector component inputs.

B. Contractor is required to thoroughly test and verify operation of all A/V inputs and video modes prior to project completion.

C. Contractor is required to focus and adjust projector to properly project image on viewing surface (screen or multimedia board depending on location).

D. Contractor shall provide owner with written verification test process and results once all projectors have been installed, tested, and placed in final condition.

E. Damage: The Contractor shall replace or rework cables showing evidence of improper handling including stretches, kinks, short radius bends, over tightened bindings, loosely twisted and over-twisted pairs at terminals and cable sheath removed too far (over 1-1/2 inches).

F. The Contractor shall replace any damaged ceiling tiles that are broken during cable installation.

G. Clean Up: All clean up activity related to work performed will be the responsibility of the Contractor and must be completed daily before leaving the facility.

3.2 DOCUMENTATION

A. Contractor shall provide owner with detailed serial number listing and associated graphical room number designation equipment was installed. Contractor shall use actual graphical package room numbers not architectural plan numbers from construction set.

3.3 STATION WIRING INSTALLATION

A. General: All cable must be handled with care during installation so as not to change performance specifications. Factory twists of each individual pair must be maintained up to the connection points at both ends of all category 6 cable. There shall never be more than one and one-quarter inch of unsheathed enhanced Category6 UTP cable at either the wiring USB Transmitter or Receiver.

B. Exposed Cable: All cabling shall be installed inside walls or ceiling spaces whenever possible. Exposed station cable will only be run where indicated on the Drawings. Additional exposed cable runs will require Owner approval and will only be allowed when no other options exist.

C. Placement: All cabling and associated hardware shall be placed so as to make efficient use of available space. All cabling and associated hardware shall be placed so as not to impair the Owner's efficient use of their full capacity.

D. Cable Routes:
1. All cabling placed in ceiling areas must be in conduit, cable tray or an approved J-Hook cable support. Cable supports shall be permanently anchored to building structure or substrates. Provide attachment hardware and anchors designed for the structure to which attached and that are suitably sized to carry the weight of the cables to be supported. Do not route cable through webbing of structural steel. Cabling must be supported in dedicated supports intended to support cabling as described in this section. Contractor shall adhere to the manufacturer's suggested fill ratio for each size cable support installed.
2. Attaching cable to pipes or other mechanical items is not permitted. Communications cable shall be rerouted so as to provide a minimum of 18 inches spacing from light fixtures, sources of heat, power feeder conduits and EMI sources. Cabling shall not be attached to ceiling. Grid support wires. Cable runs shall be routed down the corridors; parallel or perpendicular to building structure. Multiple cables to be bundled together at and between each cable support installed.
3. Contractor shall be responsible for coordinating with other trades on the project so that the installed cable pathway does not interfere with the installation of other systems to ensure that mechanical ducts, pipes, conduits, or any other above ceiling systems are not putting unnecessary stress on any portion of the install audio-video cabling.

3.4 STATION HARDWARE

A. Flush mounted components: all components shall be inserted to a flush mounted faceplate unless designated otherwise.

B. Placement: Where possible, the AV input outlets shall be located so that its centerline is 18 inches above floor level or 12 inches above permanent bench surfaces. Outlets shall

not be mounted on temporary, movable, or removable surfaces, doors, or access hatches. The CMP outlet shall route directly to the rear of the projector and does not require any type of faceplates.

3.5 PROGRAMMING

A. Programming shall be coordinated with the Owner and Project's Consultant. Programming shall include, but not be limited to the following:
   1. AV Control Panel Configuration
   2. Audio routing from any source location through the DSP
   3. Projector and screen control via the Audio / Video Control panel
   4. Device resolution and over/under-scanning settings
   5. Incorporation of any Owner furnished source equipment (maximum of 3)

3.6 FINAL TESTING REQUIREMENTS

A. Notification: The Owner and Engineer shall be notified one week prior to any testing so that the testing may be witnessed.

B. Inspection: Before requesting a final inspection, the Contractor shall perform a series of end-to-end installation performance tests. The Contractor shall submit for approval a proposal describing the test procedures, test result forms and timetable for all copper and fiber optic cabling.

C. Procedures: Trained personnel shall perform all testing. Acceptance of the test procedures discussed below is predicated on the Contractor's use of the recommended products and adherence to the inspection requirements and practices set forth. Acceptance of the completed installation will be evaluated in the context of each of these factors. Testing procedures shall consist of, but not me limited to the following:
   1. Input locations to be tested utilizing multiple types of source equipment. Equipment to include:
      a. Personal Computer (laptop)
      b. Apple iMac
      c. Apple Mac Mini
      d. Google Chromebook
      e. Additional devices may be required at the time of testing
      f. contractor to provide devices on a single cart, to roll between inputs during testing.
   2. Routing of video, from any source to each projector and display simultaneously and independently.
   3. Routing of audio, from any source to each audio channel simultaneously and independently.
   4. Control of the entire system from each installed A/V Control Panel
   5. Additional test requirements may be required at the Owner and/or Consultant's request.

3.7 OWNER TRAINING AND DEMO

A. A/V integrator shall provide demonstration of all integrated a/v solutions to owner's staff that have any stake with the operation and maintenance of the a/v solutions. Integrator shall produce sign in sheets for record of who was trained and when. Copies of sign in sheets shall be submitted with close out paperwork. Coordinate training dates with owner at project completion.

B. Integrator shall provide factory training for owner's operations and maintenance personnel for each major component of the systems listed in the A/V solutions outlined in

part 2 of these specifications. Training shall be a minimum of 4 hrs. per person. Re-training of staff shall be available, at no cost to the owner, to a maximum of 3 on-site training sessions up to 1 year from the date of project competition.

C. All training is to be recorded via video recording and a copy of the recorded video shall be provided to the owner upon completion. All video recording equipment, for the recording of training, shall be provided by the integrator.

END OF SECTION

SECTION 27 50 00

SCHOOL COMMUNICATION SYSTEM

PART 1 - GENERAL

1.1 RELATED WORK

The following, in their entirety and as applicable, shall apply to this section. Including any associated drawings.

A. Conditions of the Contract
B. Division 1
C. Division 26
D. Division 27
E. Division 28

1.2 SUMMARY

A. This section includes a fully operational IP platform for a district-wide internal and school Critical Communications Solution, incorporating school safety notifications and general communications including but not limited to the following:
   1. The platform shall provide complete internal communications and employ state of the art IP Technology including the minimum functions listed.
      a. Two-way internal intercommunications between staff locations and classrooms.
      b. Scheduled bell events.
      c. Emergency announcements that will override any pre-programmed audio, assuring that all Emergency/Lockdown etc., are heard at each and every speaker location.
      d. Capability of prerecording emergency announcements that can be activated by a Soft Key on an administrative console, panic button, dial string, or web browser.
      e. Atomic Time Synchronization with Class Change Tones utilizing multiple, programmable schedules for each zone.
      f. District-wide, Emergency, Group, All School and Zone live voice paging.
      g. District-wide, Emergency, Group, All School and Zone paging for pre-recorded audio – tones, music, and voice.
      h. Web-based user interface.
   2. The system shall support a minimum of 1000 level priorities which shall be user-definable, allowing each end point to place a minimum of 5 different priority calls at the same time.
   3. Any authorized administrator shall be able to call from outside the school into any classroom, zone, or entire school directly via the School District supplied SIP enabled Telephone Network. This shall allow remote monitoring, call-in annunciation, and two-way conversation from outside the facility as well as paging into the system. (Compliance with NEMA Standard SB-40 for emergency communications in K-12 Schools).
   4. Authorized system users shall be able to create a minimum of 100 automated sequences with voice instructions, tones, emails, program distribution, and relay activations and replay them.
   5. Automated message strings shall be manually initiated from a single-button access on the console, on a SIP connected telephone, a panic button, from the web-based user interface or via interface with third party systems.
   6. Paging and two-way intercom features shall be accessible from any system

console or SIP connected telephone for each campus.

7. The platform shall synchronize its system time to the network timeserver or a web-based time server.
8. Each single campus installation shall be locally survivable for intercom, paging, bells, and emergencies such as lockdown, even when the district connection is unavailable.
9. This specification establishes a minimum level of quality, features, and performance for individual components as well as the integrated system.
10. Systems that do not comply with the feature-sets highlighted in this Specification will not be considered.
11. Any network switches that are required shall be provided by the owner. Contractor is responsible for coordinating the switch requirements with the owner.

B. Locate equipment to accommodate millwork, fixtures, marker boards and other room equipment at no additional cost to the Owner.

C. Integrate the communications system with the following systems:
   1. Clock and Bell System
   2. Local sound reinforcement sound systems

D. Return air plenum cable shall be used. Wherever cabling is run exposed, conduit shall be used to cover and protect wiring.

E. The drawings and specifications are to be considered conceptual in nature and are intended to establish system standards insofar as manufacturer type and system configuration. The contractor shall provide pricing of a complete engineered system based on the issued conceptual documentation. The engineered system is to be submitted to the project's consultant for review prior to installation.

F. Existing Dukane system head end is to be removed with existing intercom devices and wiring integrated into existing Telecenter U controller. Provide gateways and all other hardware necessary to integrate the existing classroom and corridor speakers and intercom devices.

G. Replace Master Clock in intercom system headend. Provide new secondary clocks as indicated on drawings. Remove all other secondary clocks, including wiring. Return to owner.

H. Rewire existing lockdown buttons to Telecenter U system. Provide new lockdown buttons as indicated on drawings.

I. Prior to construction, a system test is required by the contractor, to verify the current state of the system. Any non-functioning item shall be noted and addressed by CFISD maintenance, prior to start of this work. If the system is proven to be 100% functional, the contractor is responsible for any repairs necessary to bring it to its previous state, at no additional cost to the owner.

J. If there are any discrepancies between the drawings and specification or among themselves, the contractor shall request clarification prior to providing pricing for the scope of work. If a request is not issued and a response not provided via a posted addendum, the contractor shall provide pricing for the costliest scenario and obtain clarification during the project.

1.3 DEFINITION OF TERMS

A. Installer(s): Shall refer to the person, persons, or company who or which actually contracts to perform the work specified herein.

1.4 SUBMITTALS

A. Product data for each component.

B. Shop Drawings: Prior to proceeding with the work: Provide detailed equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components, location of each field connection, and a complete schedule of all equipment and materials with associated manufacturer's cuts sheets which are to be used.
   1. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring. Identify terminals to facilitate installation, operation, and maintenance. Include a single-line diagram showing cabling interconnection of components and levels throughout system and impedances.
   2. Artwork drawings and lists indicating proposed nameplate nomenclature and arrangements for control panels and plug panels prior to fabrication reflecting equipment used.
   3. Each drawing shall have a descriptive title and all sub-parts of each drawing shall be labeled. All drawings shall have the name and locations of the project, Systems Contractor's name in the title block.
   4. Details and descriptions of any other aspect of the system, which must differ from the contract documents due to field conditions or equipment, furnished.

C. FCC Approval: The system shall be approved for direct interconnection to the telephone utility under Part 68 of FCC rules and regulations. Systems, which are not FCC approved or utilize an intermediary device for connection, will not be considered. Provide the FCC registration number of the system being proposed as part of the submittal process.

D. Product Certificates: Signed by manufacturers certifying that products furnished comply with specified requirements.

E. Installer Certificates: Signed by manufacturers certifying that Installers comply with specified requirements.

F. Manufacturer Certificates: Signed by manufacturers certifying that they comply with specified requirements.

G. Field Test Reports: Indicate and interpret test results for compliance with performance requirements. Include record of final matching transformer-tap settings, and signal ground-resistance measurement certified by Installer.

H. Maintenance Data: For equipment to be included in maintenance manuals specified in Division 1.
   1. Record of Owners equipment-programming option decisions.
   2. All instructions necessary for proper operation and manufacturer's instructions.
   3. "Proof of Performance" information.
   4. Manufacturer's maintenance information.
   5. Copies of non-proprietary computer programs and system set up disks documenting all programmable features of the installed system.

I. Record Drawings: Prior to final acceptance, provide three (3) complete sets of

drawings indicating all cable numbers and construction details in accordance with the actual system installation. Revise all shop drawings to represent actual installation conditions. These Record Drawings will be used during “Final Acceptance Testing”.

J. System Training: Submit the following information describing the training programs and system trainers as outlined in paragraph 1.6 of this specification and in accordance with Division 1 specifications.
   1. Include with the submittal a preliminary staff development training program in outline form for review and approval by the owner’s representative.
   2. Include with the submittal a current copy of the trainer’s certification from the manufacturer that certifies and identifies the trainer(s) who are eligible to provide training and support for the project.
   3. Include with the submittal a current copy of trainer’s needs assessment form which will be reviewed with the owner’s designated representative for the system’s preliminary system programming and configuration.
   4. Include with the submittal copies of all documentation used to identify for the owner those participants attending and completing the training programs.

K. A copy of the manufacturer’s standard statement of warranty proving all equipment provided for the school communications network is covered with the required five-year warranty shall be included with the project submittal. This statement of warranty shall be provided on the manufacturer’s stationary.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced Installer who is an authorized representative of equipment manufacturer for both installation and maintenance of equipment required for this Section. Provide the following within thirty (30) days after notification to proceed:
   1. Provide a list of installations that the Installer has specifically installed for verification by the Owner. Random installations from other vendors and/or Installers shall not be accepted. The Installer, not its employees, must meet these qualifications.
   2. The Installer shall be bondable.
   3. The Installer shall demonstrate to the satisfaction of the Owner or his representative that he has:
      a. Adequate plant and equipment to pursue the work properly and expeditiously.
      b. Adequate staff and technical experience to implement the work.
      c. Suitable financial status to meet the obligations of the work.
      d. Technically capable and factory trained service personnel at a local service facility to provide routine and emergency service for all products used in this project.

B. Because the life expectancy of this type of communications structure normally exceeds 10 years, the owner expects continuity from the service provider. If the installing/servicing company has not been an authorized provider of the manufacturer’s product for it least seven (7) years, the following is required:
   1. A list of two (2) systems manufacturers of which they currently are authorized service providers where the relationship exceeds seven (7) years.
   2. A letter from the manufacturer outlining the details of changes in service providers over the last seven (7) years and what actions they will take to ensure continuity of service to the customer.

C. Each major component of equipment shall have the manufacturers name, address and model number on a plate securely affixed in a conspicuous place. NEMA code

ratings, UL Label, or other data that is die-stamped into the surface of the equipment shall be easily visible.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

E. Comply with NFPA 70

F. Comply with NEMA Standard SB-40 for Emergency Communications in K-12 schools.

G. Comply with UL 60950.

1.6 SUBMITTALS

A. Project Initiation:
   1. Within fourteen (14) days of Notice to Proceed, the projection system installer shall furnish the following in a single consolidated submittal:
      a. Product Literature: Complete manufacturer's product literature for all, speakers, amplifiers, cable, cross-connect blocks, cable supports, cable labels, outlet devices, and other products to be used in the installation. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner/Designer) and the manufacturer's supporting documentation demonstrating compatibility with other related products shall be included.
      b. Construction Schedule: A time-scaled Construction Schedule indicating general project deadlines and specific dates relating to the installation of the cable distribution system.
      c. The contractor shall provide a letter from the manufacturer stating that the dealer is an authorized service center.
      d. The resume and contact information of the full-time service personnel responsible for the installed projection system.
      e. Specification Compliance: A letter shall be provided stating, by section and subsection, that the installer complies with the entire specification section. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been accepted by the project's technology consultant.
      f. Certifications: The contractor shall submit all of the following certifications, and the certifications must contain dates which are valid from the date of proposal and not expirer any sooner than 12 months after substantial completion of the project.
         1) State Licenses as applicable to this system
         2) Manufacturer's Authorized Dealer Certification
         3) Manufacture Installer Training Certificate (required for at least 25% of all installers on site.)
      g. Provide specification with line-by-line acknowledgement of compliance.

B. Shop Drawings:
   1. Submit the following items, for Owner review and approval, within twenty-eight (28) days of notice to proceed:
      a. Proposed wiring and connectivity diagram of the proposed projection system including all faceplates and sound reinforcing equipment
      b. In addition to the wiring/connectivity diagram, the submitted drawings

shall indicate the following, even if the following is expected to be provided by the project's electrical or general contractor:

1) Location of wall penetrations (all penetrations shall be sleeved and contain protective bushings at both ends)
2) Location of sleeved wall pass-thru
3) Size of sleeve at each location installed
4) Quantity of cable passing through each sleeve
5) Location of drops in each room (quantity or labeling of drops are not required in the submittal plans. Labeling shall be provided in the closeout plans and quantities shall be as per the contract documents, addendums, and issued changes. Each drop shall be labeled for the type of outlet that it is)
6) Conduit routing, size, quantity, and stub-up locations for all floor mounted outlets.

c. Drawing Compliance: A letter shall be provided stating that the installer complies with the ENTIRE project drawing, including all general, keyed, and notes to contractor. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been accepted by the project's technology consultant.

1.7 IN-SERVICE TRAINING

A. The contractor shall provide and implement a complete and comprehensive staff training program for all administrators, facility staff members, and teachers. This mandatory training program will provide school staff a complete understanding of how to utilize and properly operate all functions.

B. The training program shall be implemented by a staff member/trainer employed by the contractor. The trainer must be factory certified to provide training on their product.

C. All staff development training is to be coordinated through the owner's designated representative. As training sessions are completed, the trainer will provide the school's administrative staff and school district's staff a document listing all the staff and faculty members who attended, received, and completed the training program.

1.8 WARRANTY

A. Provide a manufacturer's five-year warranty of the school communications network equipment against defects in material and workmanship. This warranty will cover all electronic system components. Additional warranties cover clocks, speakers, and call-in switches. If any defects are found within the warranty period, the defective equipment shall be replaced at no cost (equipment only); a one-year warranty shall be provided for labor.

B. A copy of the manufacturer's standard statement of warranty proving all equipment provided for the school communications network is covered with the required five-year warranty shall be included with the project submittal. This statement of warranty shall be provided on the manufacturer's stationary. The standard five-year warranty is an important element in establishing a standard in quality. Manufacturers who circumvent the five-year warranty by offering special "extended warranties" that are not part of their normal published warranty will not be accepted.

C. Contractor shall respond, excluding weekends and holidays, within 24 hours to any

warranty service calls. If equipment cannot be repaired within 24 hours of service visit, the contractor shall provide “loaner” equipment to the facility at no charge.

D. Make available a service contract offering continuing factory authorized service of the system after the initial warranty period.

1.9 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide the following system:
   1. Telecenter U as manufactured by Rauland and installed by a Rauland authorized dealer

PART 2 - PRODUCTS

2.1 SYSTEM REQUIREMENTS

A. The New Campus Communications System will connect to the Existing District Server for District Wide announcements and all Management Functions. Server Currently Runs the Rauland Telecenter Campus Enterprise Software.

B. The platform shall utilize state of the art IP Technology for Call-in Notification, School Safety Paging and Evacuation tones, Atomic Time Synchronization, Class Change Tones utilizing multiple, programmable schedules for each zone, Two-way hands-free Internal Communications and Paging, and Program Distribution. The system shall be easy to learn and operate. All standard programming shall be web-based and user friendly to allow the system administrator the ability to easily program system features.

C. Provide complete and satisfactorily operating district/school communications and district/school safety as described herein, using materials and equipment of types, sizes, ratings, and performances as indicated. Use materials and equipment that comply with referenced standards and manufacturers’ standard design and construction, in accordance with published product information. Coordinate the features of all materials and equipment so they form an integrated system, with components and interconnections matched for optimum performance of specified functions.

D. The platform shall be a single electronic system consisting of a minimum of 10 audio channels for each campus, (classroom) IP Speaker Modules and call switches, IP Zone Modules connecting corridor speakers, inside and outside horns, IP Administrative Consoles, SIP enabled PBX integration and district-wide integration for paging, emergency notifications, calendar scheduling and configuration.

E. Each Classroom shall be provided with a Speaker Module interface and a minimum of 5 different call switches, each with their own annunciation path and priority.

F. Call-ins may automatically annunciate (display of priority and location) to administrative consoles, SIP enabled phones, and outside phones.

G. Call-ins shall be programmed to automatically change priority and annunciation route based on age of call-in and original priority.

H. Call-ins may have priority (and annunciation route) changed by user action from a console or SIP enabled phone.

I. Call-in annunciation route shall include playing pre-recorded audio over speakers,

sending a pre-configured email, and activating relays.

J. The platform shall lend itself to expansion by simple addition of hardware modules.

K. The platform shall connect directly to an existing, standard protocol WAN/LAN network, without the need for a separate server at each school location. Configuration, including bell schedules, calendars, and emergency sequences can be remotely created, changed, stored, and downloaded to the system by an authorized user from a web-based user interface.

L. The platform shall provide the ability to initiate school safety paging announcements, evacuation tones and take cover tones from any telephone or connected web browser within the facility or outside the facility to any other location within the facility or district.

M. The platform shall provide the ability to selectively communicate or monitor individual classrooms in emergency situations from any telephone within the facility or outside the facility to any other location within the facility; all communication within the classroom shall be hands-free and will not require any interaction by the classroom user.

N. The platform shall provide classroom users the ability to confirm that they have safely secured their classrooms during an emergency with a single button press. The front office administrator will receive confirmation that the classroom is safely secured via an administrative console and web-based user interface. The front office administrator can view classrooms that are not safely secured via the administrative console. The front office administrator can view classrooms that are not safely secured via the web-based user interface. The front office administrator shall be able to initiate two-way communication, without a pre-announcement tone, to the classroom during an emergency via the administrative console. Web-based user interface will still identify that a school is in an emergency, even if all classrooms are safely secured. Individual classroom check-in and school emergency status shall be viewed from the web-based user interface, both on-site and remotely.

O. IP Addressable and POE powered Speaker Modules for individual rooms shall be system programmable and may be assigned any two, three, four, five- or six-digit number as well as name and description. Any extension may be reassigned at any time.

P. IP-enabled two-way voice communication shall be available from any provided telephone or administrative console through any speaker in a campus. This shall allow hands-free communication to any classroom or any individual loudspeaker unit. A programmable pre-announce tone shall sound immediately before the intercom path is opened and a supervisory tone shall continue to sound at regular intervals when speaker monitoring is active, complying fully with all privacy legislation. Preannounce tone and supervisory tones shall be disabled during designated emergencies automatically.

Q. The platform shall allow users to configure multiple schedules per school, with a minimum of 500 unique events per schedule, and automatic Daylight Savings time correction. Schedules can be programmed to occur once, daily, weekly, monthly, or in any combination of the preceding recurrences. Each school may have a minimum of 20 unique bell schedules, with a minimum of 5 active schedules on any given day for each campus. User shall be able to select from 25 standard included tones as well additional user created and uploaded audio files for class change signaling and messaging. In addition, scheduled events shall include relay actions, email notifications, and paging exclusions as system configuration changes. The platform

shall allow control of the bell schedules via the district WAN/LAN without the need for a separate server at each school location. Bell schedules can be remotely created, changed, stored, and assigned to calendar days for the local school by an authorized user from a web-based user interface.

R. The platform shall be able to integrate with an existing PA system or operate as a fully independent IP solution. The platform shall be able to function in combination of said configurations and allow for seamless communication within a school or district-wide, regardless of the type of configuration used. The platform shall be scalable, with the ability to easily add, install, and configure additional equipment to a system.

S. The platform allows for customization of preprogrammed sequences, used for emergencies, events, and everyday communications. Preprogrammed sequences can be activated from the push of a relay button, soft key of an administrative console, a dial string of a SIP phone, or a web browser configured to the district network. Sequences can be initiated automatically as part of a schedule or on the fly. Preprogrammed sequences can be customized to utilize any combination of audio tones, emails, relays, tone exclusions, swings, delays, duples, SIP phone notifications, and program distribution. Audio tones can include customized audio files and voice messages, recorded in any language. Uploaded audio tones and messages can be preprogrammed to annunciate repeatedly or individually, as part of a scheduled sequence or on the fly. Each school in a district can have its own customized sequences, and can be activated individually, in groups, or districtwide.

2.2 EQUIPMENT AND MATERIAL

A. Server Software
   1. Provides district-wide paging, bell event scheduling, emergency notification and configuration for entire district.
   2. Ability to configure system and initiate system features, per school and district-wide via web-based user interface.
   3. The software has the ability to sync system time to the Atomic Clock Signal or to the school’s or district’s network time server.
   4. The software will provide a web browser to deliver district-wide emergency paging, pre-recorded messages, and tones from any authorized computer in the facility or the district. The software must be capable of automatically notifying district personnel via the WAN/LAN of an alarm condition.
   5. The software can automatically broadcast emergency instructions via associated system hardware throughout an entire district when an alarm (e.g., lockdown, lockout, security, fire) is initiated via the web-based user interface. The emergency instructions are preprogrammed and require no user intervention. Bell tones can be halted during an emergency. The system provides redundant alarm annunciation over intercom/paging speakers and is not meant to replace primary fire alarm or security systems.
   6. The software allows for user-uploaded pre-recorded messages and tones. Software supports the upload of MP3 and WAV file types. User-uploaded pre-recorded messages and tones can be part of emergencies, sequences, and bell schedules.
   7. The software can be installed in cloud, virtual or physical server environments.
   8. The web-based user interface supports secure HTTP browsing.
   9. The software supports encryption to ensure secure access.
   10. The system shall monitor itself if devices go offline and system actions are not received. Specified users shall receive email notifications when devices go offline. The software shall be able to keep a log and report on system activity

within a school or all schools district-wide for a minimum of one year. These reports can be exported to excel spreadsheets.

11. The software will support a minimum of 20 bell schedules per school, with 5 schedules assignable to a specific school day. Bell schedules can be programmed to annunciate tones, activate relays, send emails, activate program distribution, and notify SIP phones.
12. The system allows programmable end points to be automatically included or excluded for live paging, bell tones, or prerecorded audio, depending on the time or day or day of the week. These inclusions/exclusions can be applied manually or automatically depending on their schedule.
13. The software can automatically send an email, as part of a programmed sequence of events, to district administrators alerting them of an emergency within the district.
14. The software provides the ability to view schools that are in an emergency status, using any web browser on the district's network. The software shall identify the name of the school in an emergency as well the type of emergency that school is in.
15. The software provides the ability to view individual classrooms that are not checked-in during an emergency, using any web browser on the district's network. The software shall identify the name, extension, and description of the classroom that is not checked-in during the emergency.
16. The system has a minimum of 5 customizable emergencies, one of them being an All-Clear – with the ability to return the system from an emergency to normal status. Each emergency shall have a minimum of 500 unique events.
17. As a district-wide communications solution, the system shall be able to provide simultaneous communications to all schools or groups of schools within a district. The system shall allow a user to initiate district-wide communications to individual schools, all schools, or groups of schools, from a web-based user interface. The system shall allow a user to initiate prerecorded audio, live paging, or programmed sequences to individual schools, all schools, or groups of schools, from the web-based user interface. Programmed sequences shall be customizable per school, and the system shall be able to activate them simultaneously to individual schools, all schools, or groups of schools, from the web-based user interface.
18. The communications software must allow upgrade from an individual school system to multiple schools, or an entire school district, using the same web-based user interface. The communications software from an individual school system must be identical in typical user operation to the multiple schools or entire school district communications system software.

B. Campus Controller

1. Provides call routing for paging and intercom for a single facility.
2. System shall connect to the district provided Telephone Network via a SIP connection.
3. Support a flexible numbering plan allowing two, three, four, five, or six-digit extensions.
4. SIP interface to a district provided Telephone Network shall be capable of allowing connected phones to display classroom call-ins, answer internal intercom call-ins, make pages, and change priorities of call-ins in progress.
5. Direct dialing, two-way amplified voice intercom between any provided telephone or admin console and speaker without the use of a press-to-talk or talk-listen switch.
6. Ability to upgrade priority level from individual call switch.
7. The ability to answer intercom call-ins registered at administrative consoles and pre-selected telephones.
8. The ability to automatically escalate incoming call-ins to an alternate

telephone or group of telephones if they remain unanswered for a predetermined amount of time.

9. The ability to manually upgrade an intercom call-in to an alternate telephone or group of telephones.
10. The ability for classrooms to “check-in” via push button when they have successfully secured their location during emergency.
11. Administrative console shall display locations that have not checked in to confirm their secured location and provide hands-free audio monitoring and communication to unsecured locations.
12. The controller shall not need direct connection to any classroom via home run or distributed wiring. It shall communicate solely through the IP network.
13. Single button access from any console on the system to distribute emergency announcements within the facility to all or select locations equipped with speakers. Emergency announcements originating from any assigned administrative console shall have priority over all regular system functions.
14. Ability for administrative consoles and connected phones to selectively monitor audio at any two-way speaker during an emergency.
15. Stores a minimum of 48 hours’ worth of Bell Event Schedules, all emergency notification sequences as well as facility wide configuration.
16. System has the ability to sync system time to the Atomic Clock Signal or to the school’s or districts network time server.
17. System’s SIP Interface shall provide:
    a. Audio paging access from any telephone to any single intercom speaker, zone (group) of intercom/paging speakers, or all speakers/paging horns throughout the entire facility.
    b. Ability to answer a call-in directed to that SIP extension.
    c. Ability to upgrade a call-in directed to that SIP extension.
    d. Single button access from any telephone on the system to initiate alarm signals within the facility to all or select locations equipped with speakers. A minimum of 25 separate distinct alarm signals shall be provided. Alarm signals originating from any assigned administrative telephone shall have priority over all regular system functions.
    e. Ability to initiate a school-wide emergency including lockdown and evacuate sequences.
    f. SIP device shall display call-in information from call in switch. Information will include a minimum of Classroom Name, Number, and Priority Level.
18. The system will have the ability to utilize a web browser and a USB microphone connected to the PC to deliver district-wide live emergency paging, pre-recorded messages, and tones from any authorized computer in the facility or the district. The system must be capable of automatically notifying district personnel via the WAN of an alarm condition.
19. The system can automatically broadcast emergency instructions throughout an entire campus when an alarm (e.g., lockdown, lockout, security, fire) is tripped or manually activated. The emergency instructions are preprogrammed and require no user intervention. Bell tones can be halted during an emergency. The system provides redundant alarm annunciation over intercom/paging speakers and is not meant to replace primary fire alarm or security systems.

C. IP Addressable Modules:
1. System shall provide multiple IP Addressable Modules for intercom, paging and relay activation.
    a. All Modules are POE 802.3af compliant
    b. All Modules support DHCP.
    c. All Modules connect to network with a single RJ45 connector

2. IP Addressable Speaker Module
    a. Shall interface to school's data network, a classroom speaker, and multiple call switches.
    b. A minimum of 5 levels of call-in can be placed from an IP Speaker Module. The call-ins are routed to administrative consoles and select SIP connected telephones and can only be cleared from the system once answered. If a call-in is not answered within a preprogrammed time the call-in may reroute to other telephones, consoles, and speakers.
    c. An option for Privacy call in switches is supported. When the Privacy switch is activated, it prevents administrative or classroom telephones from monitoring the specific classroom/location intercom speaker.
    d. The ability to belong to one or more of a minimum of 100 independent zones for zone paging, program/music distribution zones and class change tone zones; this assignment is a programmable function, changeable by time of day. Each IP Speaker Module's location shall be programmed in software to belong to any combination of software zones. IP Speaker Modules shall be designed to mount near ceiling and wall speakers and in the plenum space.
    e. Intercom and paging volume adjustable from Software interface.
    f. Rauland TCC2011A with BAFKIT2X2L8RJ speaker or equal for classroomspeakers
3. IP Addressable Zone Paging Module
    a. Zone Paging Module shall connect multiple speakers for district all page, all page, zone paging, bells, audio events and, emergency notification.
    b. Zone Paging Modules shall be rack and wall mountable.
    c. Zone Paging Modules shall be able to belong to one or more of 100 independent zones for live paging, bells, pre-recorded audio, and emergency notification.
4. IP Addressable Aux I/O Module
    a. Aux I/O Module shall have two input contacts and two output contacts.
    b. Input and output contacts are individually addressable.
    c. Aux I/O Module shall be wall and rack mountable.
    d. User can program relays to be activated manually, through an event/bell schedule, or during emergency notification.
    e. Aux I/O Module can perform school lockdown from a single press of a panic button.
5. IP Addressable Program Line Input Module
    a. Program Line Input Module shall provide line level audio program distribution into system.
    b. Program Line Input Module shall have a 3.5mm cable jack.
    c. Program Line Input Module shall be configured via web-based user interface.
    d. User can configure program distribution to be activated manually or automatically through an event/bell schedule.
    e. Program Line Input Module will have a system priority level such that emergency communications override program distribution.

D. IP Addressable Analog Gateway
1. IP Addressable Gateway provides integration with existing analog wiring infrastructure – consisting of shielded two-pair classroom field wiring. The Gateway provides the ability to reuse speaker wiring, speakers, and punch blocks to integrate analog infrastructure with IP platform.
2. Each Gateway will have 5 watts of power per port and 25 watts total per

device.

3. Supports 24 classrooms that utilize 25 Volt speakers and all current Telecenter call switches for front office notification.
4. Supports minimum of 5 call switch priorities per classroom, capable of lockdown check-in functionality, while reusing existing shielded two-pair classroom field wiring.
5. Classroom intercom volume adjustable from Software interface.
6. Classroom paging volume adjustable from Software interface.
7. Configured to the school network and can be used in conjunction with IP Addressable Modules.

E. IP Addressable Administrative Console

1. A full color screen with 64 soft keys, 3 line select, volume control, push to talk, speakerphone mode and left/right and up/down scrolling.
2. Audio paging access from any Console to any single intercom speaker, zone (group) of intercom/paging speakers, or all speakers/paging horns throughout the entire school.
3. Programmable soft key access from any console on the system to initiate alarm signals within the school to all or select locations equipped with speakers. A minimum of 25 separate distinct alarm signals shall be provided. Alarm signals originating from any assigned administrative console shall have priority over all regular system functions.
4. Programmable soft key access from any console to automatically broadcast page emergency instructions throughout an entire school when an alarm (e.g., lockdown, lockout, security, fire) is tripped or manually activated. The emergency instructions are preprogrammed and require no user intervention. The system provides redundant alarm annunciation over intercom/paging speakers and is not meant to replace primary fire alarm or security systems.
5. Ability to perform intercom to any single IP Addressable Speaker Module.
6. Ability to display 3 call-ins at a time on the screen while other call-ins are annunciating and the ability to scroll to view all call-ins.
7. Ability to upgrade a call-in via soft key.
8. Programmable soft key access from any console for activating relays, campus wide.
9. Ability to maintain, along with controller and other IP Modules system functions, including intercom, bells and paging for the local campus in the event of district-wide connection loss.
10. Classrooms that have not ‘checked-in’ during an emergency are listed on the Administrative Console’s screen.
11. The time duration of an emergency is shown on the screen of the administrative console. The check-in timer is shown on the screen of the administrative console.

F. Audio Paging/Program Amplifiers – Ashly NE 8250

1. Power amplifier(s) shall be provided to provide a minimum of 2 watts of power to all paging speakers, and 15 watts of power to all paging horns.
2. The maximum load on the paging/program amplifiers shall be 80% of the rated maximum output of the amplifiers.

G. Normal/Emergency Call Switch – Rauland Dual Level Call-In Switch

1. Normal/Emergency Call Switches indicated on the drawings shall provide the following functions and features:
    a. One (1) “Normal” call switch that shall activate a distinctive “NORMAL” level call from single button activation. The button shall be clearly marked “NORMAL” and will route the call-in to any one or more Administrative Consoles and/or Marquee Displays for quick and

easy response from an Administrative Console.

b. One (1) “Emergency” call switch that shall activate a distinctive “EMERGENCY” level call from single button activation. The button shall be red in color and shall be clearly marked “EMERGENCY” and will route the call-in to any one or more Administrative Consoles and/or Displays for quick and easy response from an Administrative Consoles.

H. Emergency/Check-In Call Switch – Rauland Check-In Call-In Switch

1. Emergency/Check-In Call Switched indicated on the drawings shall provide the following functions and features:
   a. One (1) “Emergency” call switch that shall activate a distinctive “EMERGENCY” level call from single button activation. The button shall be red in color and shall be clearly marked “EMERGENCY” and will route the call-in to any one or more Administrative Consoles and/or Displays for quick and easy response from an Administrative Consoles.
   b. One (1) “CHECK-IN” call switch that shall activate a distinctive “CHECK-IN” level call from single button activation. The button shall be blue in color and shall be clearly marked “CHECK-IN” and will route the call-in to any one or more Administrative Consoles. This button will be used for emergency check-ins during school emergencies, notifying the front office of the classroom occupants’ safety during an emergency.

I. Equipment Racks

1. All equipment racks shall provide 44 spaces (77”) minimum for mounted system equipment.
2. All equipment racks shall be multi-rack format (“gangable”) style, bolted together, and open cavity.
3. All equipment racks will be provided with lockable rear doors.
4. Equipment rack(s) shall be located in climate-controlled areas/rooms as shown on drawings.
5. All head-end, distribution, and source equipment, including data and power, shall be located in racks configured as approved by the Engineer.
6. Rack mounted equipment shall be accessible from front and rear.
7. All unused rack spaces will be covered with appropriate blank/vent panels.

J. Interior Ceiling Speakers

1. Provide Ceiling Speaker Assembly consisting of 8 Ohm, 8” speaker mounted in a 2 foot by 2 foot, lay-in baffle, with an integrated back box that covers the full area of the baffle.
2. The speaker shall be connected by inserting an 8-pin RJ45 terminated CAT 5e or Cat 6 cable.
3. The speaker shall include provisions to allow attachment of a safety cable if required.
4. Quam 17URS 2X2 lay-in speaker or equal for offices and hallways.
5. Rauland ACC1400 or equal with backcan for bathrooms and hard ceilings

K. Wall Mounted Horns

1. Provide double re-entrant type horn loudspeakers with integral driver. The horn loudspeaker shall be impervious to weather and vandalism. Horn shall be constructed of heavy-duty ABS plastic. Horn loudspeaker drivers shall be rated at 15 watts with a frequency response of 480 Hz to 14 KHz. Sensitivity shall be 106 dB 1 watt, 1 meter. Transformer assembly shall be dual voltage multi-tap type suitable for 25 or 70-volt installations. Dispersion pattern shall

be 180 degrees conical. The horn loudspeaker shall be constructed of treated heavy gauge aluminum, with all exposed parts potted and a sealed driver. Wiring terminal shall be fully enclosed. The speaker flange and mounting surface shall have a cork-rubber gasket. The horn loudspeakers finish shall be gray baked on enamel.

2. The recessed back box shall be of heavy gauge cold-rolled steel, spot welded for stability with a rust-retardant gray primer finish. Acoustically treat the interior to eliminate mechanical resonance. The back box shall be 10-3/4”x10-3/4”x6” deep.
3. The baffle shall be vandal proof, the faceplate constructed of 14-gauge carbon steel with a minimum tensile strength of 55,000 PSI. A lattice grid sub-plate shall deny access to the horn but be acoustically transparent for sound projection. Provide tamper-proof, stainless steel mounting hardware. The baffle shall a mar/scratch baked epoxy rust inhibitive finish.

L. Uninterruptible Power Supplies (UPS)
1. UPS equipment provided for this system will include Power Conditioning to smooth current and voltage fluctuations.
2. UPS equipment will be sized in accordance with the system manufacturer’s recommendations.
3. Provide an individual UPS for EACH remote gateway outside of the MDF (Gateway) furnished with the system.
4. Provide additional UPS(s) for protection of all other equipment furnished with the system and housed in the equipment racks.
5. All UPS equipment shall be rack mounted.

M. Wall Mounted Volume Control
1. Provide as shown on floor plans. Provide Atlas AT-10PA or approved equal recessed autotransformer volume control. Routine paging shall not override the volume control.

N. Wall Mounted Emergency Lockdown Button
1. Provide Safety Technology International Stopper Station Push, Turn-to-Reset w/shield w/sound, or pre-approved equal in locations as shown on floor plans.
2. Labeled “LOCKDOWN”
3. Lockdown shall be Blue

O. Program Source Equipment
1. RDL D-J3 wall mounted RCA and XLR mic/line input panel, or equal, located at receptionist desk, connected to system headend.

P. Surge Protector
1. Provide TrippLite IsoBar

Q. Clock System
1. Master clock power supply and clocks by Sapling.
   a. Provide 16” clocks at following locations; Cafeteria/commons, Library
   b. Provide 12” clocks at following locations: Clinic, receptionist desk

P. Additional Equipment:
1. Contractor shall include in their pricing, the cost to furnish and install the following additional equipment. These devices shall be used to fulfill any changes request issued until the list is depleted. Upon the completion of the project, all remaining material shall be delivered to the project for owner stock. No devices shall be used without documentation and written authorization from the project’s technology consultant. Contractor shall obtain a signed

transmittal of additional equipment to the owner at the end of the project. The signed transmittal shall be included in the contractor's closeout documents.

2. Additional Equipment List:
   a. Five (5) Ceiling Mounted Speakers with tile bridges
   b. Two (2) Wall Mounted Volume Controls
   c. One (1) Exterior Speakers

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with the Installer present, for compliance with requirements and other conditions affecting the performance of the School Communications and School Safety Network.

B. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install system in accordance with NFPA 70 and other applicable codes. Install equipment in accordance with manufacturer's written instructions.

B. Furnish and install all material, devices, components, and equipment for a complete operational system.

C. Impedance and Level Matching: Carefully match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.

D. Control Circuit Wiring: Install control circuits in accordance with NFPA 70 and as indicated. Provide number of conductors as recommended by system manufacturer to provide control functions indicated or specified.

E. All housings are to be located as indicated.

F. The contractor shall provide necessary transient protection on the AC power feed, all copper station lines leaving or entering the building, and all central office trunks. All protection shall be as recommended by the equipment supplier and referenced to earth ground.

G. Wiring within Enclosures: Provide adequate length of conductors. Bundle, lace, and train the conductors to terminal points with no excess. Provide and use lacing bars.

H. Provide physical isolation from speaker-microphone, telephone, line-level wiring, and power wiring. Run in separate raceways, or where exposed or in same enclosure, provide 12-inch minimum separation between conductors to speaker-microphones, telephone wiring and adjacent parallel power. Provide physical separation as recommended by equipment manufacturer for other system conductors.

I. Identification of Conductors and Cables: Use color coding of conductors and apply wire and cable marking tape to designate wires and cables so all media are identified in coordination with system wiring diagrams.

J. Provide integration of local sound reinforcement system override.

K. Provide integration of remote lockdown pushbuttons.

L. Install new speaker types as indicated on the drawings.

M. Speakers in high ambient noise areas (cafetorium, gymnasiums, etc.) shall be tapped as required to overcome the ambient noise generated by the public.

N. Provide silicone sealant to all openings and conduit penetrations at all exterior back box locations.

O. Weatherproofing: Provide weatherproof enclosures for items to be mounted outdoors or exposed to weather.

P. All exterior wall penetrations shall be properly sealed to prevent moisture from entering the building.

Q. Conduit and Cables
1. Install conduit, fittings and boxes as specified in Division 26.
2. Single system cables shall be grouped together in a common conduit of adequate capacity to facilitate the ease of installation and prevent conductor or insulation damage.
    a. In no case shall the conduit fill exceed 40% capacity.
    b. Do not group conductors or cables of different systems in a common conduit.
    c. Provide and install protective bushings on all conduit stub outs and sleeves, prior to cable installation, to prevent cable damage.
3. Cable:
    a. Install cables as recommended by the system manufacturer. Conductor quantities specified are minimum required. Conductors to be installed shall be coordinated with the system equipment supplier.
    b. Cables installed on exposed surfaces, in inaccessible locations, or underground shall be installed in conduit.
    c. Cables installed above accessible ceiling spaces may be installed without conduit. All cables not installed in conduit shall be plenum rated.
    d. Cables shall be routed down corridors, parallel and perpendicular to the building walls and structure. Cable to each device shall branch off a main corridor trunk.
    e. Routing cables through classrooms, offices, storage rooms, restrooms, or any type of room other than a corridor will not be accepted. Enter rooms above the associated room doorway.
    f. All cabling shall be home runs to head-end equipment to allow for zoning to be accomplished.
4. Cables not installed in conduit shall be grouped and bundled. Cable shall be bundled on a maximum of 2'-6" on center. Support cables from D-rings or J-hooks. D-rings and J-hooks shall be secured to the structure at a maximum of 5' on center. Bundling and support shall be with plenum rated cable ties.
5. Cables installed in hollow wall spaces shall be installed in conduit to an accessible location.
6. Tag each circuit at each end and at each terminal with a separate tag indicating the area served.

R. Emergency Lockdown Buttons
1. Cabling for each Emergency Lockdown Button shall be homerun to the Communication System head-end equipment.
2. Communications system shall communicate with intrusion system over the network when there is a lockdown event.
3. Provide connection from the Communication System head-end equipment to

the Intrusion Detection System head-end for sending notifications to the CFISD Police Department. Coordinate additional requirements and programming with Owner.

4. Button shall cause the Intercom System to send a distinct alert tone throughout all speakers in the building. Coordinate exact tone with Owner.
5. Button shall send an Emergency Call signal to all Administrative Call Stations.
6. Communication System shall alert essential personnel via SMS and e-mail that a Lockdown event has occurred at the campus. Coordinate additional requirements with Owner.
7. Buttons and alert tone shall be reset by pressing the All-Clear button on any Administrative Call Station console.
8. Coordinate Emergency Lockdown Button device identification naming with Owner.

S. Volume Controls

1. Volume Controls shall be configured with emergency call override, allowing emergency announcements to be heard regardless of the position of the volume control.

3.3 ADDITIONAL REQUIREMENTS

A. Provide visual PA indicator light in deaf education areas and wire into the communications system for bell tones.

3.4 GROUNDING

A. Provide equipment grounding connections for Integrated Electronic Communications Network systems as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounds.

B. Racks and cabinets shall be grounded to the metallic structure of the building or to the building system power ground in accordance with NEC section 250. Securely bond equipment to the ground system through a minimum 14-gauge green insulated conductor.

C. Ground equipment, conductor, and cable shields to eliminate shock hazard and to minimize to the greatest extent possible, ground loops, common mode returns, noise pickup, cross talk, and other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.

D. Electronic systems shall be grounded to the building system ground, with a maximum resistance of 0.1 ohm. Systems ground shall be a driven ground rod, building steel, or other approved ground of the building power systems ground.

E. Provide all necessary transient protection on the AC power feed and on all copper station lines leaving or entering the building. Note in system drawings, the type and location of these protection devices as well as all wiring information.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide services of a duly factory authorized service representative for this project location to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.

B. Inspection: Make observations to verify that units and controls are properly labeled, and interconnecting wires and terminals are identified. Provide a list of final tap

settings of paging speaker line matching transformers.

C. Testing: Rectify deficiencies indicated by tests and completely re-test work affected by such deficiencies at Contractor's expense. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

3.6 FINAL ACCEPTANCE TESTING

A. The Final Acceptance Testing shall be provided to the Owner, or the Owners designated representative only. Final acceptance testing to any other trade or service provider for the project will not comply with the requirements of this section.

B. The contractor will provide a Final Acceptance Test record document signed by both the contractor and the Owner or designated Owner's Representative establishing the "In Warranty" date. The warranty period will not commence until the Final Acceptance Test is completed.

C. Be prepared to verify the performance of any portion of the installation by demonstration, listening and viewing test, and instrumented measurements. Make additional adjustments within the scope of work and which are deemed necessary by the Owner because of the acceptance test.

3.7 COMMISSIONING

A. The contractor shall train the Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventative maintenance of the system. This training will be in accordance with the training as outlined in Section 1.6 of these specifications. In addition to the Training Materials provided, the contractor will also furnish Operators Manuals and Users Guides at the time of this training.

B. Schedule training with Owner through the Owner's representative, with at least seven days advance notice.

3.8 OCCUPANCY ADJUSTMENTS

A. The contractor shall provide Occupancy Adjustments in accordance with Section 1.6 of these specifications. A response scenario amenable to both the owner and the contractor will be established and followed for the first year of service.

3.9 CLEANING AND PROTECTION

A. Prior to final acceptance, the contractor shall vacuum and clean all system components and protect them from damage and deterioration. All blank spaces in equipment cabinets will be covered with blank panels. Top and side panels, and all cabinet doors will be installed. All general areas within and around all equipment rack/cabinets in the facility will be swept, vacuumed, and cleaned up. No cabinets will be left unlocked, and all cabinet keys will be turned over to the owner or designated owner's representative.

END OF SECTION

SECTION 28 01 00

OPERATION AND MAINTENANCE (O&M) MANUALS OF ELECTRONIC SAFETY AND SECURITY SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Compile Electronic Safety and Security (ESS) product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare ESS operating and maintenance data as specified in this Section and as referenced in other sections of specifications.

B. Instruct Owner's personnel in operation and maintenance of equipment and systems.

C. Submit three (3) electronic copies, on separate devices (CD, USB Flash Drive, or some type of solid-state storage device), of complete O&M manuals in final form. The submitted manual shall be the system manufacturer's operations manual, supplemented with operations and maintenance instructions custom tailored for the system installed. Electronic documentation shall be provided in a non-proprietary PDF format, without password restrictions.

D. Hard copies shall be provided upon request of the Owner, Architect, and/or Consultant.

E. Recorded video of all training sessions shall be included in each copy, of each system's final submitted O&M.

F. The final submitted manual shall include a sing-in sheet and owner/consultant signed acceptance of all training sessions.

1.2 ELECTRICAL OPERATING AND MAINTENANCE MANUAL SUBMITTAL SCHEDULE

A. Thirty (30) days after receipt of reviewed submittals bearing the Project Technology Consultant's stamp of acceptance (including re-submittals), submit for review, an electronic copy of the first draft of the System's O&M Manual. This copy shall contain as applicable to the specific system, a minimum of the following:

1. Table of Contents for each element
2. Contractor information
3. All shop drawings, coordination drawings and product data, bearing the Project technology Consultant's stamp of acceptance.
4. All parts and maintenance manuals for items of equipment
5. Warranties (without starting dates)
6. Certifications that have been completed; submit forms and outlines of certifications that have not been completed
7. Operating and maintenance procedures.
8. Form of Owner's Training Program Syllabus (including times and dates)
9. Control operations / equipment wiring diagrams
10. Coordination Drawings
11. Schedule of Low Voltage Wire and Cable
12. Schedule of ESS Equipment
13. Schedule of ESS Field Devices
14. Access Control Door Schedules
15. Video Surveillance Camera Schedules
16. Other required operating and maintenance information that are complete.

17. Cable pathway layout drawings and station map, including through wall and floor penetration locations and sleeve sizes.

B. Copy will be returned to the Contractor within 15 days with comments for corrections.

C. Submit the electronic completed manuals (hard copies upon request) in final form to the Project's Technology Consultant.
   1. Prior to substantial completion for Owner's use after the Owner accepts facility maintenance.
   2. Include all specified data, test reports, drawings, dated warranties, certificates, training videos. along with other materials and information.

D. The Project's Technology Consultant shall review the manuals for completeness within 15 days.

E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Project's Technology Consultant. The manuals will not be retransmitted.

F. Electronic and/or hard copies of the accepted manuals shall be delivered to the Owner prior to substantial completion.

PART 2 - PRODUCTS

2.1 BINDERS

A. Upon the request for hard copies of the O&M manuals, the binders shall consist of the following configuration:
   1. Commercial quality black, 3-ring binders with clear, durable, cleanable plastic covers.
   2. Minimum ring size: 1"; Maximum ring size: 3".
   3. When multiple binders are used, correlate the data into related groupings.
   4. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

3.1 SYSTEM OPERATION AND MAINTENANCE MANUAL

A. Form for Manuals Submitted in Hard Copy Format:
   1. Prepare data in form of an instructional manual for use by Owner's personnel.
   2. Format:
      a. Size: 8-1/2" x 11"
      b. Text: Manufacturer's printed data or neatly typewritten.
   3. Drawings:
      a. Provide reinforced punched binder tab and bind in text.
      b. Fold larger drawings to size of text pages.
   4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
   5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
      a. Title of Project
      b. Identity of separate structures as applicable
      c. Identity of general subject matter covered in the manual.
   6. Binder as specified

B. Content of Manual:
   1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
      a. Contractor, name of responsible principal, address and telephone number
      b. A list of each product required to be included, indexed to content of the volume.
      c. List with each product, name, address and telephone number of:
         1) Subcontractor or installer
         2) Maintenance contractor as appropriate
         3) Identify area of responsibility of each.
         4) Local source of supply for parts and replacement
      d. Identify each product-by-product name and other identifying symbols as set forth in Contract Documents.
   2. Product Data:
      a. Include those sheets pertinent to the specific product.
      b. Annotate each sheet to:
         1) Identify specific product or part installed.
         2) Identify data applicable to installation.
         3) Delete references to inapplicable information.
   3. Drawings:
      a. Supplement product data with drawings as necessary to illustrate:
         1) Relations of component parts of equipment and systems
         2) Control and flow diagrams
      b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
      c. Do not use Project Record Documents as maintenance drawings.
   4. Written text as required to supplement product data for the particular installation:
      a. Organize in consistent format under separate headings for different procedures.
      b. Provide logical sequence of instructions for each procedure.
   5. Copy of each warranty, bond and service contract issued
      a. Provide information sheet for Owner's personnel, giving:
         1) Proper procedures in event of failure
         2) Instances that might affect validity of warranties or bonds
   6. Shop drawings, coordination drawings and product data as specified.

C. Sections for Equipment and Systems
   1. Content for each unit of equipment and system as appropriate:
      a. Description of unit and component parts:
         1) Function, normal operating characteristics, and limiting conditions.
         2) Performance curves, engineering data and tests.
         3) Complete nomenclature and commercial number of replaceable parts.
      b. Operating procedures:
         1) Start up, break-in, routine / normal operating instructions
         2) Regulation, control, stopping, shut down and emergency instructions
         3) Special operating instructions
      c. Maintenance procedures:
         1) Routine operations
         2) Guide to trouble-shooting

3) Disassembly, repair and reassembly
4) Alignment, adjusting and checking
5) Routine service based on operating hours

d. Manufacturer's printed operating and maintenance instructions.
e. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
1) Items recommended to be stocked as spare parts.
f. Schedule of low voltage wire and cable
g. Schedule of ESS equipment
h. Schedule of ESS field devices
i. Each Contractor's coordination drawings.
1) As installed color coded wiring and cabling diagrams.
j. List of original manufacturer's spare parts and recommended quantities to be maintained in storage.
k. Other data as required under pertinent sections of the specifications.

2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications
4. Provide complete information for products specified in Division 27.
5. Provide certificates of compliance as specified in each related section.
6. Provide start up reports as specified in each related section.
7. Provide signed receipts for spare parts and material.
8. Provide training report and certificates.

END OF SECTION

SECTION 28 05 00

ELECTRONIC SAFETY AND SECURITY
BASIC MATERIALS, METHODS, AND GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of Division 01 General Requirements, and other provisions and requirements of the Contract Documents apply to work of Division 28 Electronic Safety and Security.

B. Applicable provisions of this section apply to all sections of Division 28, Electronic Safety and Security.

C. The general provisions of the Contract and the requirements of the following Sections apply to the Work specified in this Section. See following sections for related general and specific requirements following sections shall associate with this specification as applicable.
1. Division 26 in its entirety.
2. Division 27 in its entirety.
3. Division 28 in its entirety.

D. The entire drawing and specification package apply to the work specified in the Electronic Safety and Security specifications and shall be complied with in every respect. The Contract Documents are comprised of the drawings and specifications. The Contractor shall examine these Contract Documents, and coordinate required work indicated in each.

1.2 CODES AND STANDARDS

A. All equipment and work performed shall comply with all of the current and applicable Codes, Rules, Ordinances, Regulations and Standards (including those not specifically listed in this Specification) as interpreted and enforced by the authorities having jurisdiction including:
1. Americans with Disabilities Act (ADA)
2. Authorities Having Jurisdiction (AHJ) - Local
3. American National Standards Institute (ANSI)
4. American Society of Testing and Materials (ASTM) *Communications Cables - B694, B736, D4565, D4566, D4730, D4731, D4732*
5. Building Industry Consulting Services International (BICSI)
6. Code of Federal Regulations - Title 47
7. Electronics Industries Association (EIA) *Standard Test Procedures for Fiber Optic Fibers, Cables, Transducers, Connecting and Terminating Devices - EIA-455 Series*
8. Federal Communications Commission (FCC) - Communications Act and FCC Rules
9. Federal Information Processing Standards (FIPS) *Federal Building Standard for Telecommunications Pathways and Spaces - FIPS PUB 175, FIPS PUB 176*
10. The Insulated Cable Engineers Association (ICEA) *Communications Cable Stands - P-47-434, S-56-434, S-80-576, S84-608, S-85-625, S-86-634, S-87-640, S-89-648, S-90-661, S-98-688, S-99-689, S-100-685*

11. International Electro-technical Commission (IEC)
12. Institute of Electrical and Electronic Engineers (IEEE) *Local Area Networks/Metropolitan Networks Standards Collection - LAN/MAN 802 Series*
13. International Organization for Standardization (ISO) (ISO/IEC) *Premise Wiring Core and LAN/MAN Core Equivalents-11801, 8802, 14763-1*
14. International Telecommunication Union (ITU-T) *Telecommunications Standardization*
15. National Electrical Code (NEC) *National Electrical Code - NFPA 70*
16. National Electrical Contractor's Association (NECA) *Standards of Installation*
17. National Electrical Manufacturers Association (NEMA) *Performance Standard for Twisted Pair Premise Voice and Data Communications Cable-WC 63.1, WC 63.2, WC 66*
18. National Electrical Safety Code (NESC)
19. National Fire Protection Association (NFPA) - *National Fire Alarm Code NFPA 72, Life Safety Code NFPA 101*
20. Society of Cable Telecommunications Engineers (SCTE)
21. Local Accessibility Standards
22. Telecommunications Industries Association (TIA) *(ANSI/TIA/EIA) Wiring and Cabling Standards - 526, 568, 569, 570, 571, 598, 606, 607, 758, TSB 31-B, 63, 67, 72, 75 and 95*
23. Uniform Building Code (UBC)
24. Underwriters Laboratories, Inc. (U.L.) - *497A, 910, 1077, 1863, 1283, 1459, 1604, 1651, 1681, 1690, 1778, 1977*

B. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.

C. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.

D. Obtain all permits required.

1.3 SUMMARY

A. The work covered by the specifications includes furnishing materials, labor, transportation, tools, permits, fees, utilities, and incidentals necessary for the complete installation of work required in the Contract Drawings.

B. It is the intent of the Contract Documents to provide a new and/or an extension of the existing installation, as shown in the associated specifications and drawings, complete in every respect.

C. Provide complete and working ESS Systems including equipment, conduit, wiring, material, labor and training as described in this Specification and the Drawings. The ESS Systems Drawings and Specifications are the sole property of the Architect and are not to be duplicated, scanned, loaned or in any way made available to persons not designated as authorized by the Architect. All ESS Systems plans and specifications are to be returned to the Architect following completion of bid.

1.4 CONTRACTOR'S QUALIFICATIONS

A. An approved contractor for the work under this division shall be:
   1. A specialist in this field and have the personnel, experience, training, and skill,

and the organization to provide a practical working system.

2. Able to furnish evidence of having contracted for and installed not less than ten (10) systems of comparable size and type that have served their Owners satisfactorily for not less than 3 years.
3. Perform work by persons qualified to produce workmanship of specified quality. Persons performing work shall be required to be licensed. Onsite supervision shall have minimum of the following:
    a. Licenses, as applicable to the system being installed
    b. Manufacturer's Certifications
        1) Firm Certification
        2) Installer Certification
        3) Programmer's Certification
        4) System Designer Certification.

1.5 DRAWINGS AND SPECIFICATIONS

A. The drawings and these specifications are complementary to each other, and what is required by one shall be as binding as if required by both.

B. If variations or departures from the drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore shall be submitted to the Consultant for review. No departures shall be made without prior written acceptance of the Consultant.

C. Should the drawings or specifications disagree in themselves or with their counterpart, the better quality or greater quantity of work or materials shall be estimated upon, and unless otherwise directed by the Consultant in writing, shall be performed or furnished. In the case that the specifications should not fully agree with the Schedules, the latter shall govern. Figures indicated on drawings govern scale measurements and large-scale details govern small scale drawings.

D. The approximate locations of system equipment and components are indicated on the Drawings. These Drawings are not intended to give complete and accurate details in regard to location of equipment, field devices, etc. Exact locations are to be determined by actual measurements at the building and will in all cases be subject to the Review of the Owner or Consultant, who reserves the right to make any reasonable changes in the locations indicated without additional cost to the Owner.

E. Items specifically mentioned in the Specifications but not shown on the Drawings and/or items shown on Drawings but not specifically mentioned in the Specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.

F. Any discrepancies between the Contract Documents and actual job site conditions shall be reported to the Owner or Consultant, so that they will be resolved prior to the bidding, where this cannot be done at least 7 working days prior to bid; the greater or costlier of the discrepancy shall be bid. All labor and materials required to perform the work described shall be included as part of this Contract.

G. It is the intention of this Section of the Specifications, and associated drawings, to outline minimum requirements to furnish the Owner with a turnkey and fully operating system in cooperation with other trades.

H. The contract documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working

construction drawings. The actual working construction drawings shall be the shop drawings accepted by project's consultant.

I. The Contractor shall be responsible for coordination and proper relation of his work to the building structure and to the work of all trades. The Contractor shall visit the premises and thoroughly familiarize himself with the existing site conditions, details of the work and the working conditions, and verify dimensions in the field. The Contractor shall advise the project's consultant of any discrepancy prior to bidding. The submission of bids shall be deemed evidence of the Contractor's site visit; coordination of existing conditions and include consideration for existing conditions.

J. These documents are conceptual in nature. It shall be the responsibility of the approved installer to furnish a complete and functional system, including the items shown on the drawings, in the specifications, and items not designated in either. The installer's shop drawings and product data submittals shall represent a complete system and documents accepted by the project's consultant shall not relieve the installer from being required to provide any materials, equipment, or labor to furnish a complete and functional system as recognized by the Project's Technology Consultant and the Owner.

1.6 BUILDING CONSTRUCTION AND LAYOUT OF WORK

A. General: It shall be the responsibility of the Contractor to consult the Engineering Drawings and Details so as to thoroughly familiarize himself with the type and quality of construction to be provided on this project.

B. The drawings are diagrammatic in nature and do not show every connection in detail or every line or conduit in its exact location. These details are subject to the requirements of all codes, ordinances, and standards; as well as all structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be laid out so that it will be concealed in closed ceiling space and/or furred chases unless specifically noted or indicated to be exposed. Work shall be installed to avoid crippling of structural members. All work shall be run parallel or perpendicular to the lines of the building unless otherwise noted.

C. The approximate location of equipment items is indicated on the drawings. Exact locations are to be determined by coordination of dimensions from approved equipment submittals and site-verified field measurements and will in all cases be subject to the approval of the Consultant. The Consultant reserves the right to make any reasonable changes in the indicated locations prior to installation for no additional cost.

D. In areas of existing special ceiling construction, the removal and restoration must be carefully planned such that the existing condition of the ceilings is maintained. It may be necessary for the Contractor to procure a Subcontractor familiar with this work to achieve this requirement.

E. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.7 RELATION WITH OTHER TRADES

A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements. Extend electrical services and final connections to all items requiring same.

B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.

C. Where cabling pass through walls or floors, metal sleeves shall be provided and shall be sealed to prevent spread of fire and smoke. In walls, they shall extend 3” beyond the finished surface. In pipe chases, they shall extend 8” inches above floor slab and be cemented in a watertight manner. Size of these sleeves shall be at least as required to maintain a maximum 40% conduit fill ratio.1/2 inch greater than outside diameter of the conduit.

D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.

E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under other Division. Determine from the General Contractor / Construction Manager for the various trades, the Owner, and by direction from the Architect / Engineer, the exact location of all items. The construction trades involved shall furnish all roughing-in drawings and wiring diagrams required for proper installation of the electrical work.
   1. Make final connections to all ESS equipment indicated on the drawings, except as noted.

F. Request all Shop Drawings required in ample time to permit proper installation of all electrical provisions.

G. Extend services as indicated to the various items of equipment furnished by others. Rough-in for the various items and make final connections ready for operation upon placing of the equipment.

1.8 CONCEALED AND EXPOSED WORK

A. When the word "concealed" is defined as hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is defined as open to view, in plain sight.

1.9 GUARANTEE

A. Guarantee work for a minimum of two years or as noted longer elsewhere from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.10 MATERIAL AND EQUIPMENT

A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.11 NOISE AND VIBRATION

A. Select equipment to operate with minimum noise and vibration. If noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, and judged objectionable by the Owner, Architect, or Engineer, rectify such conditions at no additional cost to the Owner. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.12 ACCEPTABLE MANUFACTURERS

A. Manufacturers names and catalog number specified under sections of Division 28 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer shall be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before proposal due date. Submit complete design and performance data to the Architect. The Architect and Owner issue approvals of acceptable manufacturers as addenda to the Construction Proposal Documents.

B. Where acceptable manufacturers are listed, only products of those manufacturers may be provided. Additionally, the product must meet all the detailed requirements of the specifications.

C. If no manufacturer's name is mentioned, the Contractor shall provide equipment and material which meet the specifications.

1.13 UTILITIES, LOCATIONS AND ELEVATIONS

A. Locations and elevations of the various utilities included within the scope of this work:
   1. Obtained from utility maps and other substantially reliable sources.
   2. Are offered separate from the Contract Documents as a general guide only without guarantees to accuracy.

B. Examine the site and verify the location and elevation of all utilities and of their relation to the work. Existing utilities indicated on the site plans are for reference only and shall be field verified by the Contractor with the respective public or private utility.

1.14 CONTRACT DRAWINGS

A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

B. It is the responsibility of the Contractor to compare the scale of all electrical drawings with the scale of the architectural drawings and make adjustments to all electrical drawings which have the incorrect drawing scale so that his material takeoffs are not in error due to an incorrectly labeled drawing scale and his proposal is complete.

1.15 ABBREVIATIONS AND DEFINITIONS

Abbreviations:

A/V	Audio/Visual
AWG	American Wire Gauge
BCR	Building Communications Room
CMP	Communications Media Plenum
CMR	Communications Media Riser

dB	Decibel
EMI	Electromagnetic Interference
ER	Equipment Room
ESS	Electronic Safety and Security
FACP	Fire Alarm Control Panel
FCR	Floor Communications Room
Hz	Hertz
IDF	Intermediate Distribution Frame
Km	Kilometer
LCD	Liquid Crystal Display
LED	Light Emitting Diode
M	Micron
MDF	Main Distribution Frame
MHz	Megahertz
NEXT	Near-End Cross Talk
nm	Nano-meter
OFN	Optical Fiber Non-conductive
OFNP	Optical Fiber Non-conductive Plenum
OFNR	Optical Fiber Non-conductive Riser
OTDR	Optical Time Domain Reflectometer
TC	Telecommunications Closet *(Now referred to as TR)*
TR	Telecommunications Room *(A.K.A. TC - Telecommunication Closet)*
UTP	Unshielded Twisted Pair Wire

Definitions:

Low Voltage Wire - Wire or cable used for one or more systems that operate on 24 volts or less. Low Voltage Wire is used to install and interconnect one or more of the ESS Systems. Low Voltage Wire includes patch cords, jumpers and all portions of cable or wire used to make the ESS Systems operational or for system communications.

Electronic Safety and Security Systems - One or more of the following and associated equipment: Fire Detection/Alarm Systems, Intrusion Detection/Alarm Systems, Access Control Systems, Video Surveillance Systems,

1.16 QUALITY ASSURANCE

A. Equipment Standards:
   1. System and all components shall be brand new stock from manufacturer.
   2. All electronics shall be 100% solid state.
   3. System and all components shall bear a UL Label.

B. Contractor Qualifications:
   At the time of Proposal, the Contractor shall:
   1. Have manufactured, supplied or installed at least three (3) other systems of similar size, complexity, and general operation as the systems described in these specifications. The Contractor shall furnish in writing to Architect proof of compliance with this paragraph at the time of proposal.
   2. Hold all legally required Texas State Contractor's licenses necessary to accomplish the installation and activation of the described system at the facilities indicated. The Contractor shall submit copies of licenses to the Architect prior to the start of work
   3. Hold all legally required state registrations to meet local requirements for submittal drawings.

4. Have a local office within fifty (50) miles of the project site staffed with factory trained technicians who have experience on systems of similar complexity and function as the systems described in these specifications. These technicians shall be fully capable of system engineering support, installation supervising, system start-up, and providing the Owner with training and service on both hardware and software for the systems specified.
5. Certify complete and total compliance with the provisions of these specifications by letter or submittal of the proposal response forms, signed by an officer of the corporation, or a principal if other ownership currently exists. In addition, the letter or forms shall include a complete listing of exceptions, if any.

1.17 SUBMITTALS

A. Provide SUBMITTALS according to Division 1 and the following.

B. Requirements:
1. Submit paragraph-by-paragraph specification review indicating compliance or deviation with explanation.
2. Submit proof that all system components and cables are U.L. Listed.
3. An equipment list with names of manufacturers, model numbers, and technical information on all equipment proposed. Clearly mark exact model number proposed to be installed.
4. Product technical information sheets for each principal components in the proposed system, including cable, wire, terminal marking, and wire marking material.
5. Certification from the manufacturer stating that the system Contractor is an authorized distributor or installer of the proposed system when such certifications exist.
6. A statement listing every technical and operational parameter wherein the submitted equipment varies from that which was originally specified. If the submitter fails to list a particular variance and his submittal is accepted, but is subsequently deemed to be unsatisfactory because of the unlisted variance, the submitter shall replace or modify such equipment at once and without cost to the Owner.

1.18 EXAMINATION OF SITE

A. The Contractor shall have visited the site and familiarized himself with all existing conditions prior to submitting his proposal and shall be prepared to carry out the work within the existing limitations. Failure or neglect to do so shall not relieve the Contractor of his responsibilities not entitle him to additional compensation for work overlooked and not included in his proposal.

B. The Contractor shall confirm the availability of the proper power source for each piece of specified equipment, through site visits and Drawings as necessary. Where proper power does not exist, the Contractor shall provide the required power, circuits, outlets, conduits, and wire as specified under Division 26.

1.19 DATA ACCURACY

A. Absolute accuracy of information regarding existing conditions cannot be guaranteed. The Drawings and Specifications are for the assistance and guidance of the Contractor and exact locations, distances, elevations, etc., shall be governed by actual field conditions. Where variations from the contract documents are required,

such variations shall be approved by the Architect / Owner.

1.20 SECURITY

A. The Contractor is responsible for complying with all of the Owner's and facility security's requirements to prevent theft or damage to equipment, tools and materials. If any deviation from facility security requirements is necessary, approval for such deviation shall be coordinated with the Owner.

B. The Contractor shall not disclose any confidential information of the Owner. The Contractor acknowledges that such action is highly injurious and can do damage to the Owner. The Contractor will agree to and comply with the standard policies and provisions of the Owner regarding outside Contractors and Consultants.

1.21 UTILITIES

A. It shall be the responsibility of the Contractor to provide all temporary connection and cables, lighting, light stands and power. The facilities shall be used in accordance with all applicable regulations regarding operations, safety and fire hazards of the governmental Authorities Having Jurisdiction, provided they are not used in a wasteful manner.

1.22 PERMITS

A. All permits required for the specified performance and completion of the work shall be secured by the Contractor. These permits shall be presented and reviewed at the initial project progress meeting.

1.23 NOTIFICATION

A. The Contractor shall not shut off any existing systems. The Contractor shall give the Owner at least ten (10) calendar day’s notice of any requirements to shut off or interference with existing alarm, regulating, computer or other service systems. The Owner will arrange and execute any shutdown. All work such as splicing, connections, etc., necessary to establish or re-establish any system shall be completed by the Contractor in close coordination with the Owner.

1.24 INTERFERENCES WITH THE OWNER

A. Transportation and storage of materials at the facility, work involving the facility, and all other matters affecting the habitual use by the Owner of its buildings, shall be conducted so as to cause the least possible interference, and at times and in a manner acceptable to the Owner. The Contractor shall make every effort to delivery equipment per the schedule required by the project.

1.25 PROJECT RECORD DOCUMENTS

A. Maintain at the job site a separate set of white prints (blue line or black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is significantly at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various major and minor feeders, equipment, and other pertinent items, as installed. Record underground and underslab cables installed, dimensioning exact location and elevation of such installations.

B. At conclusion of project, obtain without cost to the Owner, electronic AutoCAD 2014+ / Revit CAD files of the original drawings and transfer as-built changes to these. Provide the following as-built documents including all contract drawings regardless of whether corrections were necessary and include in the transmittal: “2 sets of CDs and prints for Owner’s use, one set of CDs, prints, and mylars for Architect / Engineers Records”. Delivery of these as-built electronic, reproducible and prints is a condition of final acceptance.
   1. 3 sets of electronic AutoCAD (2014+ dwg) / Revit CAD drawing files, on CD-ROM media, of each contract as-built drawing.
   2. One reproducible Dayrex mylar film positive of each contract as-built drawing.
   3. Three sets of blue or black-line prints of each contract as-built drawing.

C. As-Built Drawings should indicate the following information as a minimum:
   1. Indicate all addendum changes to documents.
   2. Remove Engineer’s Seal, name, address, and logo from drawings.
   3. Mark documents AS-BUILT DRAWINGS.
   4. Clearly indicate: DOCUMENT PRODUCED BY:
   5. Indicate all changes to construction during construction. Indicate actual routing of all conduit and cables, etc that were deviated from construction drawings.
   6. Indicate exact location of all underground ESS raceways, and elevations.
   7. Correct schedules to reflect (actual) equipment furnished and manufacturer.
   8. During the execution of work, maintain a complete set of Drawings and specifications upon which all locations of equipment, devices, and all deviations and changes from the construction documents in the work shall be recorded.
   9. Exact location of all ESS equipment in building. Label panel schedules to indicate actual location.
   10. Exact location of all ESS equipment in and outside of the building.
   11. Location, size and routing of all ESS cables, conduits, equipment, etc. shall be accurately and neatly shown to dimension.
   12. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
   13. Cloud all changes.

1.26 OPERATING TESTS

A. After all ESS systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect / Engineer and Owner. Provide minimum 24-hour advance notice of scheduling of all tests. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.27 WARRANTY

A. All equipment shall be covered for the full manufacturers warranty period and systems shall be warranted by the Contractor for a period of two years commencing with the filing date of substantial completion. The Warranty shall cover all costs for warranty service, including parts, labor, prompt field service, pick-up, transportation, delivery, reinstallation, and retesting. A contract for service shall cover the period starting with the first expected activation of each system and shall continue without interruption to

cover the period to the end of the two-year warranty as defined above. The end of the warranty period shall be handled such that a smooth transition to a maintenance agreement with the Owner shall be achieved with no lapse in coverage.

B. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.28 BUILDING CONSTRUCTION

A. It shall be the responsibility of the sub-contractor to consult the Architectural and Engineering drawings, details and specifications and thoroughly familiarize himself as to the construction and all job-related requirements. All construction trades shall cooperate with the General Contractor / Construction Manager job site superintendent and lay out work so that all piping, cables, pathways, raceways, and other items are placed in the walls, furred spaces, chases, etc., so that there shall be no delay in the job.

1.29 TEMPORARY FACILITIES

A. General: Refer to Division 01 for general requirements on temporary facilities.

B. Temporary Wiring: Temporary power and lighting for construction purposes shall be provided under Division 26. Installation of temporary power shall be in accordance with NEC Article 305.

C. Temporary facilities, wire, lights and devices are the property of this Contractor and shall be removed at the completion of the Contract.

1.28 EXTRA MATERIALS

A. Keys: Provide three (3) sets of all keys for system cabinets.

PART 2 - PRODUCTS

2.1 WORK INCLUDED

A. All materials listed in PART 2 - PRODUCTS of this Division Sections and on the Drawings shall be provided by the Contractor unless specifically excluded or modified in other portions of this Specification or Addendums.

2.2 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

A. Materials, in general, shall conform to the National Electrical Code requirements and shall be listed, inspected, and approved by the Underwriters Laboratories and shall bear the UL label where labeling service is available. The label or listing of the Underwriters Laboratories, Inc. will be accepted as evidence that the materials or equipment conform to the applicable standards of that agency. In lieu of this listing, the Contractor may submit a statement from a nationally recognized, adequately equipped testing agency, indicating that the items have been tested in accordance with required procedures, and that the materials and equipment comply with all Contract requirements.

2.3 STANDARD PRODUCTS

A. Materials and equipment shall be the standard catalog products of manufacturers

regularly engaged in the manufacture of products conforming to these specifications and shall essentially duplicate materials and equipment that have been in satisfactory use at least two (2) years prior to bid opening. Where custom or special items are required, these shall be fully described using drawings, material lists, etc., which fully describe in detail the item proposed for use on this project.

2.4 MANUFACTURE'S INSTRUCTIONS

A. The Contractor is responsible for furnishing the proper Electronic Safety and Security equipment and/or material and for seeing it is installed as intended by the manufacturer. The Contractor shall, wherever necessary, request advice and supervisory assistance from equipment manufacturers as required for the proper installation, operation, or start-up. The Contractor shall notify the Consultant, in writing, of any conflict between the Contract Documents and the manufacturer's recommendations and shall obtain, from the Consultant, instructions/direction before proceeding with the work. The Contractor shall pay for all costs resulting from deficiencies created by installation not in accordance with the manufacturer's recommendations or the instructions of the Consultant.

2.5 RUST PREVENTION

A. Metallic materials shall be protected against corrosion. Exposed metallic parts of equipment exposed to the elements shall be given a rust inhibiting treatment and standard finish by the manufacturer. Components such as boxes, bodies, fittings, guards, and miscellaneous parts shall be protected in accordance with the ASTM A123 or A153, except where other equivalent protective treatment is specifically approved in writing.

2.6 STORAGE AT SITE

A. The Contractor shall not receive material or equipment at the job site until ready for installation or until there is suitable space provided to properly protect equipment from rust, weather, humidity, dust, or physical damage.

B. All electronic equipment, containing sealed lead acid batteries or gel cells, shall be stored in climate-controlled area until installed or reinstalled. Do not store in non-climate controlled connex storage units.

C. Storage is to be provided and secured by the contractor. In the event that the Owner should agree to furnish storage space, security of the space and its contents shall remain the responsibility of the contractor.

2.7 CONDITION OF MATERIALS

A. All materials required for the installation of the Electronic Safety and Security systems shall be new and unused. Any material or equipment damaged in transit from the factory, during delivery to premises, while in storage on premises, while being installed, or while being tested, until time of final acceptance, shall be replaced by this Contractor without extra cost to Owner.

2.8 NAMEPLATES

A. Factory assembled components and equipment shall be provided with be factory stamped labeling. Labeling will have information required to specifically identify the component and/or equipment in the future such as the manufacturer's name, catalog

number, serial number, etc. All data on the labels shall be legible at the time of final inspection.

2.9 ACCESS DOORS

A. Wherever access is required in walls or ceilings to concealed junction boxes, pull boxes, equipment, etc., installed under this Division, furnish a hinged access door and frame with flush latch handle to another Division for installation. Doors shall be as follows:
   1. Plaster Surfaces: Milcor Style K.
   2. Ceramic Tile Surfaces: Milcor Style M.
   3. Drywall Surfaces: Milcor Style DW.
   4. Install panels only in locations approved by the Architect.

2.10 SPACE LIMITATIONS

A. Equipment shall be chosen which shall properly fit into the physical space provided and shown on the drawings, allowing ample room for access, servicing, removal and replacement of parts, etc. Adequate space shall be allowed for clearances in accordance with applicable codes and standards. Physical dimensions and arrangement of equipment shall be subject to the approval of the Consultant.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. This project has a critical path, which must be closely followed in order to meet the completion date. The Contractor shall review the proposed schedule at the Award of Contract meeting and be prepared to staff his work force according to the schedule constraints presented at that time.

B. Aesthetics are an important consideration in this installation. All components shall be installed so as to have aesthetically pleasing results as determined by the Owner and Architect. Actual locations of all visible components shall be coordinated in advance with the Owner and Architect.

C. Install, make fully operational and test the system as indicated on the Drawings and in the Specifications. Where information is not available the worst-case condition must be assumed to ensure a complete, functional system.

D. Any interfacing with other systems shall be the Contractor's responsibility under this contract, and the details, both logical and physical, of such interfaces shall be reflected in the Submittals and As-Built drawings.

E. If appropriate, interfaces with the Owner's Data Network or Telecommunications System shall be coordinated with the Owner and Architect.

F. All necessary back boards, back-boxes, pull-boxes, connectors, supports, conduit, cable and wire shall be furnished and installed to provide a complete and reliable system. Exact location of all backboards, boxes, conduit and wiring runs shall be presented to the Owner / Architect for approval in advance of any installation. Provide as required and as specified in Division 26.

G. Where required provide 120-VAC, 60 Hz power from nearest electrical panel through a junction box, to the system devices. Provide as required and as specified in Division

26.

H. Where required, install conduit, cable and wire parallel and square with building lines, including raised floor areas. Conduit fills shall not exceed 40%.

I. All equipment shall be mounted with sufficient clearance to minimize EMI as well as meet all applicable codes and facilitate observation and testing. Securely hand and/or fasten with appropriate fittings to ensure positive grounding, free of ground loops, throughout the entire system. Units shall be installed parallel and square to building lines.

J. Quiet and vibration-free operation of all equipment is a requirement of this installation. Properly adjust, repair, balance or replace any equipment producing objectionable (in the judgment of the Owner or Architect) noise or vibration in any of the occupied areas of any building and provide additional brackets and bracing if necessary. Any such additions or changes shall be at no additional cost to the Owner.

K. Installation shall comply with the CODES AND STANDARDS portion of this Section. Where more than one code or regulation if applicable, the more stringent shall apply.

L. Where new equipment is replacing old equipment, the Contractor is responsible for removing and disposing of the old equipment and doing whatever repair work is necessary as specified by the Owner / Architect.

M. Install firestopping, as specified in Division 26 for all penetrations in slabs and firewalls to meet code at the completion of work and prior to final testing demonstration to the Owner.

N. The installation shall be performed in a professional manner.

O. On a daily basis, clean up and deposit in appropriate containers all debris from work performed under the appropriate specification sections. Stack and organize all parts, tools and equipment when not being used.

P. Preparation, handling and installation shall be in accordance with the Manufacturer's written instructions and technical data appropriate to the product specified.

Q. All work shall conform to the National Electrical Contractor's Association "Standard of Installation" for general installation practice.

R. At the conclusion of the installation, all work areas, including all enclosures and boxes, shall be vacuumed and cleaned to remove all debris and grease.

3.2 COORDINATION WITH OWNER / ARCHITECT

A. Close coordination with the Owner / Architect is vital to achieve a complete, aesthetically pleasing job. The Contractor shall ensure that the Owner / Architect is kept fully apprized of job progress.

3.3 CUTTING, PAINTING, AND PATCHING

A. Structural members shall not be drilled, bored or notched in such a manner that shall impair their structural value. Cutting of holes in structural members, if required, shall be done with core drills and only with the specific approval of the Owner / Architect for each instance.

B. All walls that require cutting or repair during the installation process shall be returned to their original condition, including the matching of colors and finishes to the satisfaction of the Owner / Architect, and at no additional cost to the Owner.

3.4 WIRE AND CABLE

A. All low voltage cable shall be low smoke plenum rated, limited energy, with 300-volt insulation.

B. All wires in exposed areas shall run through conduit as specified in Division 26.

C. Provide conduits, cable trays, raceways, wireways, boxes and outlets as specified in Division 26.

D. After installation, and before termination, all wiring shall be checked and tested to insure there are no grounds, opens, or shorts on any conductors. In addition, all wires between buildings or underground and all coax cables shall have insulation tested with a megohmeter (megger) and a reading of greater than 20 megohms shall be required to successfully complete the test.

E. Run wires continuously from termination to termination without splices.

F. Wire and cable shall be supported in each equipment and terminal cabinet and in each terminal and pull box in vertical risers and horizontal runs with wire duct and strap-type supports. At any point where wire duct is required for good wire management, whether shown on elevations or not, install appropriate duct. Where terminal boards are used, wire ducts shall be supplied on both sides and at not rime shall wires cross over terminal boards. Arrange cables neatly to allow inspection, removal and replacement. Lace cables as required. Spot tie wire bundles with plastic cable ties and securely affix to panels. If screw type terminals are specified, terminal strip connections shall be locking, tongue style, pressure crimp, and solderless spade lug.

G. Visually inspect wire and cable for faulty insulation prior to installation. Protect cable ends at all times with acceptable end caps except during actual termination. At no time shall any coaxial cable be subjected to a bend less than a 6-inch radius. Protect wire and cable from kinks. Install 1 pull rope for all 2” or larger sized conduits.

H. Provide plastic bushings and strain relief material at all conduit exit points and where necessary, to avoid abrasion of wire and excess tension on wire and cable.

I. Cables above accessible ceilings shall not rest on ceiling tiles. Use Velcro tie wraps, J-hooks or D-rings to hold cables. Provide independent support for all cables. Support is to be from building structure (do not support from pipes or conduits). ESS cables shall not tie off on HVAC supports, all-thread, ceiling grid hanger wire or electrical / mechanical piping system.

J. Ground and bond equipment and circuits in accordance with NEC and Division 26.

3.5 IDENTIFICATION AND TAGGING

A. All cables, wires, wiring forms, terminal blocks and terminals shall be identified by labels, tags to other permanent markings in accordance with TIA/EIA-606. The markings shall clearly indicate the function, source, or destination of all cabling, wiring

and terminals. All cables and wires shall be identified, utilizing heat-shrink, machine printed, polyolefin wire markers (Brady Type B-32 *or equal*). Handwritten tags are not acceptable.

B. Should a situation arise where the wire tagging format as shown on the drawings cannot be used, a substitute format shall be submitted which complies with the intent to provide documentation that will permit end-to-end tracing of all ESS Systems wiring.

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.

3.6 CUTTING AND PATCHING

A. General: Comply with the requirements of Division 01 for the cutting and patching of other work to accommodate the installation of electrical work. Except as authorized by the Architect / Engineer, cutting and patching of electrical work to accommodate the installation of other work is not permitted.

3.7 INSTRUCTION OF OWNER'S PERSONNEL

A. Before proceeding with the instruction of Owner Personnel, prepare a typed outline, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he has a proper understanding of the operation and maintenance of the systems and resubmit the signed outlines.

B. Prior to substantial completion, conduct an on-site training program to instruct Owner's operating personnel in the operation and maintenance of the ESS systems.
   1. Provide the training during regular working day.
   2. The Instructors shall be experienced in their phase of operation and maintenance of the electrical systems and with the project.

C. Time to be allocated for instructions.
   1. Minimum of 12 hours dedicated instructor time
   2. 4 hours on each of 3 days
   3. Additional instruction time for specific systems as specified in other Sections.

D. Before on-site training, submit the program syllabus; proposed time and dates; for review and approval, minimum 48 hours prior to proposed training time and date.
   1. One copy to the Owner
   2. One copy to the Architect / Engineer

D. The Owner shall provide a list of personnel to receive instructions and shall coordinate their attendance at the agreed upon times.

E. Use operation and maintenance manuals as the basis of instruction. Review manual with personnel in detail. Explain all aspects of operation and maintenance.

F. Demonstrate start-up, operation, control, adjustment, troubleshooting, servicing, maintenance, and shut down of each item of equipment.

G. Demonstrate equipment functions (both individually and as part of the total integrated system).

H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.

I. Submit a report within one week after completion of training. List time and date of each demonstration, hours devoted to the demonstration, and a list of people present, with their respective signatures.

J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he/she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.

K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

3.8 OPENINGS

A. Framed, cast or masonry openings for boxes, equipment or conduits are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.9 OBSTRUCTIONS

A. The drawings indicate certain information pertaining to surface and subsurface obstructions, which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
   1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
   2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.

B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.10 VANDAL RESISTANT DEVICES

A. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner 2 suitable tools for use with each type of fastener used.

B. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.11 PROTECTION

A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

B. Do not deliver equipment to this project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather shall be rejected, and the contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.

3.12 EQUIPMENT BACKBOARDS

A. Backboards: ¾ inch, fire retardant, exterior grade plywood, painted gray, both sides.
   1. Provide minimum of two 4-ft. by 8-ft. sheets of plywood for each location shown.
   2. Provide minimum of two 4-ft. by 4-ft. sheets of plywood for each ESS location.

3.13 SITE MANAGEMENT RESPONSIBILITY

A. The Contractor shall provide an on-site Project Manager as defined in CONTRACTOR'S QUALIFICATIONS portion of this Section.

3.14 DEMOLITION AND RELOCATION

A. The Contractor shall modify, remove, and relocate all materials and items so indicated on the drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain as directed by the Owner. Materials and items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to the approval of the Owner. The Contractor may substitute new materials and items of like design and quality in lieu of materials and items to be relocated, if approved by the Owner.

B. All items scheduled for relocation and/or reuse shall be inspected by the Contractor and the Owner or his authorized representative. A written report of the condition of each item shall be made and provided to the Consultant. Where items scheduled for relocation and/or reuse are considered unsuitable for reuse, the Contractor shall so notify the Consultant and await reinstallation instructions before proceeding with removal. Items damaged in reinstallation shall be repaired or replaced by the Contractor as directed by the Owner at no additional cost to the Owner or the Consultant.

C. All items which are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean, repair, and provide all new materials, fittings, and appurtenances required to complete the relocation and to restore the items to good operative order. All relocations shall be performed by workmen skilled in the work ad in accordance with standard practice of the trades involved.

D. Service lines and wiring to items to be removed, salvaged, or relocated shall be removed to points as indicated on the drawings, specified, or acceptable to the Owner. Service lines and wiring not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied off or connections into the existing facilities in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities which must remain in operation during the construction period shall not be interrupted without prior specific written approval of the Consultant.

3.15 EXISTING SYSTEM TESTING

A. Contractor shall have each low voltage system tested prior to the commencement of construction. Systems shall include all systems that fall under the Division 28 umbrellas, as identified in the Division 2 of the Construction Specifications Institute (CSI) current Master Format7 Test shall include the functionality of all field devices and equipment. Any failures or items found to be functioning not to specification, shall be reported prior to construction. Any items found to be improperly or non-functioning upon the completion of the project, shall be replaced and/or repaired, by the contractor, at no additional cost to the project or the owner.

B. Contractor shall document the location and any ID tag, MAC address, IP address, or bar code of any existing device that is to be removed from its current location. Devices that are to remain, shall be reinstalled in the exact location that they reside in prior to construction, unless noted otherwise.

C. Any individual/firm that will be removing, relocating, reinstalling, or tampering with any devices; shall be licensed by the state and certified by the manufacturer of the system.

D. Contractor shall remove any devices where construction occurs to prevent possible damage to the device. Removal of any devices which support user connection or other systems, shall be coordinated with the owner prior to removal and/or taking offline.

3.16 START-UP RESPONSIBILITY

A. The Contractor shall initiate System operation. The Contractor shall provide competent Start-Up personnel on each consecutive working day until all ESS Systems are functional and ready to start the acceptance test phase. If the Contractor, in the Owner / Architect's judgment, is not demonstrating progress in solving any technical problems, the Contractor shall supply Manufacturer's factory technical representation and diagnostic equipment at no cost to the Owner, until resolution of those defined problems. Where appropriate, the Contractor shall bring the Systems on-line in their basic state (i.e., alarm reporting, facility code access control, etc.) It is the responsibility of the Owner to provide the specific database information that will be utilized for initial system programming.

B. Properly ground each piece of electronic equipment prior to applying power. Properly ground all shielded wire shields to the appropriate earth ground at the hub end only, not at the remote or device end.

C. Use a start-up sequence that incrementally brings each portion of the system on-line in a logical order that incorporates checking individual elements before proceeding to subsequent elements until the entire system is operational. The basic steps should include:
   1. Establish ground planes at the equipment rooms and hub end of the systems as specified in Division 26.
   2. Disconnect power, connect the first device, reconnect power, and verify operational correctness. Repeat until the entire system is verified and operational.

3.17 PREPARATION FOR ACCEPTANCE (SUBSTANTIAL COMPLETION)

A. All systems, equipment, and devices shall be in full and proper adjustment and operation, and properly labeled and identified.

B. All materials shall be neat, clean and unmarred, and parts securely attached.

C. All extra material as specified shall be delivered and stored at the premises as directed.

D. Test reports of each system and each system's components and As-Built Project Drawings shall be complete and available for inspection and delivery as directed by the Owner.

3.18 SYSTEM ACCEPTANCE REQUIREMENTS

A. Before final acceptance or work, the Contractor shall perform and/or deliver each of the following in the order stated.

B. The Contractor shall deliver three (3) composite “System Operations and Maintenance” manuals in three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain in appropriately tabbed sections:
   1. A statement of Guarantee including date of termination and the name and phone number of the persons to be called in the event of equipment failure.
   2. A set of Operating procedures for the overall System that includes all required Owner activities, and that allows for the Owner operation of all attributes and facilities of the System.
   3. A section for each specific type of equipment containing the vendor manuals, instruction sheets, and any related literature that cam in the original shipping container for that piece of equipment. Include all warranty cards.

C. Testing:
   1. The Contractor shall perform all tests required by Division 28 and those submitted as part of this Section.
   2. The Contractor shall activate all devices for proper system operation, including supervisory and trouble circuit tests. Similarly, audible alarms will not be activated except on a one-time, coordinated basis, to check the actual sounding devices.
   3. A test report for each piece of equipment shall be prepared by the Contractor and submitted to the Owner. This report shall include a complete listing of every device, the date it was tested, by whom and the results. The final test reports shall indicate that every device tested successfully. Failure to completely test and document the tests will result in a delay of final testing and acceptance.

D. As-Built Drawings:
   1. After completion of all the tests listed above, and prior to the final acceptance test, The Contractor shall submit the complete As-Built drawings as identified in PART 1 – PROJECT RECORD DRAWINGS.
   2. The final As-Built Drawings shall consist on one set of reproducible prints, two (2) sets of Point-to-Point Detail Drawings, Equipment Schedules, and the complete detailed technical data that was shipped by the manufacturer with all installed equipment.

E. Final Acceptance Test: The Final Acceptance Test shall demonstrate the installed and activated System’s performance and compliance with System Specifications. However, before this testing can begin the following must have received and reviewed by the Owner.
   1. System Operations and Maintenance Manuals
   2. System Test Reports
   3. As-Built Drawings

3.19 NOTICE OF COMPLETION

A. When the Final System Acceptance Requirements described above including the Final Acceptance Test described above have been satisfactorily completed. The Owner / Architect shall issue a Letter of Completion to the Contractor indicating the date of such completion. The Notice of Completion shall be recorded by the Contractor upon receipt of the Owner / Architect completion letter. This date of record shall be the start of the warranty period.

END OF SECTION

SECTION 28 05 07

SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Prepare submittals as required by Division 1 and as outlined below.

B. Submit product data shop drawings only for the following and for items specifically requested elsewhere in the Contract Drawings and Specifications. Architect / Engineer reserves the right to refuse shop drawings not requested for review and to imply that materials shall be provided as specified without exception.

C. The term submittal, as used herein, refers to all:
1. Shop Drawings
2. Coordination Drawings
3. Product data

D. Submittals shall be prepared and produced for:
1. Distribution as specified
2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.

B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.

C. Identify field dimensions; show relation to adjacent or critical features or work or products.

1.3 COORDINATION DRAWINGS

A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: 1/4"=1'-0".

B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.

C. For each room containing ESS equipment and each rack with ESS equipment, submit plan and elevation drawings. Show:
1. Actual ESS equipment and components to be furnished.
2. NEC working space and NEC access to NEC working space.
3. Relationship to other equipment and components and openings, doors and obstructions
4. Rack location and dimensions

D. Identify field dimensions. Show relation to adjacent or critical features of work or

products.

E. Verify location of ESS station devices and other work specified in this Division.
   1. Coordinate with drawing details, site conditions and millwork shop drawings prior to installation.
   2. Where required for clarification, submit shop drawings prior to rough-in and fabrication.

F. Submit shop drawings in plan, elevation and sections, showing outlets and other devices in casework, cabinetwork and built-in furniture.

1.4 PRODUCT DATA

A. All product options specified shall be indicated on the product data submittal. All options listed on the standard product printed data not clearly identified as not part of the product data submitted shall become part of the Contract and shall be provided.

B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.

C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.

D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.

E. Mark up a copy of the specifications for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect / Engineer/Owner (Does Not Comply, Explanation:)

1.5 MANUFACTURERS INSTRUCTIONS

A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up and adjusting.

1.6 CONTRACTOR RESPONSIBILITIES

A. Review submittals prior to transmittal.

B. Determine and verify:
   1. Field measurements
   2. Field construction criteria
   3. Manufacturer's catalog numbers
   4. Conformance with requirements of Contract Documents

C. Coordinate submittals with requirements of the work and of the Contract Documents.

D. Notify the Architect / Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.

E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect / Engineer's acceptance.

F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect / Engineer reviews submittals or not.

G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect / Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations on reviewed documents.

H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
   1. Proper sizes and capacities
   2. That the item will fit in the available space in a manner that will allow proper service
   3. Construction methods, materials and finishes

I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

1.7 SUBMISSION REQUIREMENTS

A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.

B. Number of submittals required:
   1. Shop Drawings and Coordination Drawings: Submit four opaque reproductions.
   2. Product Data: Submit the number of copies the contractor requires, plus those to be retained by the Architect / Engineer.

C. Accompany submittals with transmittal letter, in duplicate, containing:
   1. Date
   2. Project title and number
   3. Contractor's name, address and telephone number
   4. The number of each Shop Drawing, Project Datum and Sample submitted
   5. Other pertinent data

D. Submittals shall include:
   1. The date of submission
   2. The project title and number
   3. Contract Identification
   4. The names of:
      a. Contractor
      b. Subcontractor
      c. Supplier
      d. Manufacturer
   5. Identification of the product
   6. Field dimensions, clearly identified as such
   7. Relation to adjacent or critical features of the work or materials
   8. Applicable standards, such as ASTM or federal specifications numbers
   9. Identification of deviations from contract documents

10. Suitable blank space for General Contractor and Architect / Engineer stamps
11. Contractor's signed and dated Stamp of Approval

E. Coordinate submittals into logical groupings to facilitate interrelation of the several items.
1. Finishes which involve Architect / Engineer selection of colors, textures or patterns
2. Associated items requiring correlation for efficient function or for installation

1.8 SUBMITTAL SPECIFICATION INFORMATION

A. Every submittal document shall bear the following information as used in the project manual:
1. The related specification section number
2. The exact specification section title

B. Submittals delivered to the Architect / Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.9 RESUBMISSION REQUIREMENTS

A. Make resubmittals under procedures specified for initial submittals.
1. Indicate that the document or sample is a resubmittal
2. Identify changes made since previous submittals

B. Indicate any changes which have been made other than those requested by the Architect / Engineer.

1.10 CONTRACTOR'S STAMP OF APPROVAL

A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.

B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect / Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.

C. Do not deliver any submittals to the Architect / Engineer that do not bear the Contractor's stamp of approval and signature.

D. Submittals delivered to the Architect / Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.11 ARCHITECT / ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

A. The Architect / Engineer will:
1. Review identified submittals with reasonable promptness and in accordance with schedule. Specific equipment submittals that may be required to be expedited shall be submitted separately without other submittal items not

requiring the same prompt attention.
2. Affix stamp and initials or signature, and indicate requirements for resubmittal or approval of submittal
3. Return submittals to Contractor for distribution or for resubmission

B. Review of submittals will not extend to design data reflected in submittals that is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.

C. Architect / Engineer's review is only for conformance with the design concept of the project and for compliance with the information given in the contract.
1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.

D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

1.12 SUBSTITUTIONS

A. Do not make requests for substitution employing the procedures of this Section.

B. The procedure for making a formal request for substitution is specified in Division 01.

PART 2 - PRODUCTS - NOT USED.

PART 3 - EXECUTION

3.1 SHOP DRAWINGS AND PRODUCT DATA

A. Submittals shall not be combined or bound together with any other material submittal.

B. Submit individually bound shop drawings and product data for the following when specified or provided:
1. Low Voltage Wire
2. Electronic Access Control and Intrusion Detection
3. Electronic Surveillance
4. Fire Detection and Alarm

3.2 COORDINATION DRAWINGS

A. Submit coordination drawings as specified.

END OF SECTION

SECTION 28 05 10

CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Contract quality control including workmanship, manufacturer's instructions, mock-ups and demonstrations.

1.2 QUALITY CONTROL PROGRAM

A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents.

1.3 WORKMANSHIP

A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.

B. Perform work by persons qualified to produce workmanship of specified quality.

C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.

D. Provide finishes to match approved samples; all exposed finishes shall be approved by the Architect / Engineer. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

A. Comply with instructions in full detail, including each step in sequence.

B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

A. When required in individual Specification Sections, manufacturer shall provide a manufacturer’s qualified personnel to observe:
   1. Field conditions.
   2. Condition of installation.
   3. Quality of workmanship.
   4. Start-up of equipment.
   5. Testing and adjusting of equipment.

B. Manufacturer’s qualified personnel shall make written report of observations and recommendations to Architect / Engineer.

1.7 MOCK UPS

A. Assemble and erect the specified equipment and products complete, with specified anchorage and support devices, seals and finishes.

B. Do not proceed with any work involving a mock-up, until the related mock up has been approved in writing.

C. Acceptable mock-ups in place shall be retained in the completed work where possible.

D. Perform tests and submit results as specified.

1.8 SCHEDULING OF MOCK-UPS

A. Schedule demonstration and observation of mock-ups, in phases, with Architect / Engineer.
   1. Rough-in
   2. Finish with all appurtenances in place
   3. Demonstrations

PART 2 - PRODUCTS

2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS

PART 3 - EXECUTION

3.1 ADJUSTMENTS AND MODIFICATIONS

A. Contractor shall provide all adjustments and modifications as requested by the manufacturer’s qualified personnel at no additional cost to Owner.

3.2 MOCK-UPS

A. Mock up a typical classroom, science lab of each type, and computer lab with all wiring devices, cover plates, rough-in boxes, conduits, etc. provide all conductors from all wiring devices to above ceiling space to demonstrate conduit routing and conductor fill.

END OF SECTION

SECTION 28 05 50

FIRESTOPS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide firestop as required, and as specified. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.

B. Types: Firestop required for the project includes smokestop.

1.2 QUALITY ASSURANCE

A. UL Label: Firestops shall be UL labeled.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Nelson.

B. 3M (Minnesota Mining Manufacturing).

C. Hilti

D. Specified Technologies, Inc.

2.2 MATERIAL AND COMPONENTS

A. General: Except as otherwise indicated, provide firestop manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended by the manufacturer, and as required for installation.

2.3 FIRESTOP

A. Conduits: Provide a soft, permanently flexible sealant for 1-1/2 to 2 hour rated fireproofing for steel conduits (up to 4" diameter).

B. Low Voltage Cables, Fiber Optic Cable and Innerduct: Provide Specified Technologies, Inc. EZ-Path single, double, or triple pathways as required.

PART 3 - EXECUTION

3.1 INSTALLATION OF FIRESTOPS

A. General: Install firestops in accordance with the manufacturer's installation instructions and industry practices to ensure that the firestops comply with requirements. Comply with UL and NFPA standards for the installation of firestops.

END OF SECTION

SECTION 28 10 00

ACCESS CONTROL SYSTEM (ACS)

PART 1 - GENERAL

1.1 RELATED WORK

A. The following, in their entirety and as applicable, shall apply to this section. Including any associated drawings.
   1. Conditions of the Contract
   2. Division 1
   3. Division 26
   4. Division 27
   5. Division 28

1.2 WORK INCLUDED

A. Reference Attachment 'A' of this specification for supplemental scope and product material list as it relates to the project and the Owner standards.

B. ACS devices indicated are for reference and coordination purposes only. The System Installer shall design and provide a complete system, meeting the requirement of specification. Installer shall provide all system devices required to established controlled access and monitoring at locations designated in the contract documents. The system installation shall be in compliance with all governing authorities and the Architect, Engineer, and Owner expectations.

C. Security system devices indicated are for reference and coordination purposes only. The System Installer shall design and provide a complete system, meeting the requirement of specification. The installer shall provide all security system devices required for complete system perimeter coverage acceptable to all governing authorities, Architect and Owner.

D. The system shall include security for all access into building, including but not limited to the following:
   1. Control Panels
   2. Power Supplies
   3. Interconnection of panels
   4. Installation of new devices
   5. Card reader
   6. Magnetic locking hardware
   7. Request to exit devices
   8. Door position sensors
   9. Door Hardware (as specified herein and/or in Division 08, door hardware)
   10. Lockdown and Lockout Buttons
   11. Audio / Video Intercom Systems
   12. All additional material, hardware, and labor required for a fully functional, turnkey system

E. The System Installer shall connect each controller to the ACS Management System.

F. All system programming will be performed by the system installer. The system installer will be required to meet with the Owner, engineer, and system manager to discuss wiring and termination of the system control panels and field devices prior to

installation.

G. Licensing: The System Installer shall NOT utilize any of the owner's existing licensing for this scope of work. All licensing shall be provided by the System Installer, no exceptions. Including, but not limited to the following:
   1. Portal Licensing
   2. Controller Licensing
   3. Wireless Licensing
   4. Video Management Software Integration Licensing

H. System Installer to refer to Division 08 Door Hardware Specification. Provide and install all hardware specified to be provided by the "Access Control Contractor", "Security Installer", "Division 28", or any variation thereof.

I. System Installer to provide and install door hardware as specified in Specification Section 28 10 00.05 Door intercom system.

J. 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.

K. Remove all existing edge controllers. Provide new cabling and connections to existing and new doors, from centralized controllers. Controllers and card readers that are removed shall be returned to owner.

1.3 REFERENCES

A. Code of Federal Regulations (CFR).

B. Institute of Electrical and Electronics Engineers (IEEE):
   1. 802.3 Ethernet Standards.
   2. IEEE 1100 Recommended Practice for Powering and Grounding Electronic Equipment.

C. International Electrotechnical Commission (IEC).

D. International Organization for Standardization (ISO):
   1. ISO / IEC 10918 - Information technology -- Digital compression and coding of continuous-tone still images: Requirements and guidelines; JPEG.
   2. ISO / IEC 14496-10 - Information Technology - Coding Of Audio-Visual Objects - Part 10: Advanced Video Coding; MPEG-4 Part 10 (ITU H.264).
   3. ISO / IEC 23008-2 - High Efficiency Coding and Media Delivery In Heterogeneous Environments - Part 2: High Efficiency Video Coding; MPEG-H Part2 (ITU H.265, HEVC).

E. Federal Communications Commission (FCC):
   1. FCC Part 15 – Radio Frequency Device

F. Underwriters Laboratories (UL):
   1. UL294 – Access Control Systems Units

G. Electronic Industries Alliance (EIA)
   1. RS485 - Electrical Characteristics of Generators and Receivers for use in Balanced Digital Multi-Point Systems

H. Federal Information Processing Standards (FIPS)
   1. Advanced Encryption Standard (AES) (FIPS197)
   2. FIPS201-2: Open Options DNA Fusion FIPS in conjunction with an E2-SSP-D2-FIPS, NSC-100-FIPS, RSC-2-FIPS and other listed components will provide an access control solution that is fully FIPS 201-2 compliant.
   3. Personal Identity Verification (PIV) of Federal Employees and Contractors

I. Homeland Security Presidential Directive 12 (HSPD12)

J. National Fire Protection Association Standards:
   1. NFPA 70 - National Electrical Code
   2. NFPA 72 - National Fire Alarm Code
   3. NFPA 101 - Life Safety Code

K. RoHS compliant

L. SIA AC-01-1996.10 - Access Control - Wiegand

M. Local & State Building Codes

N. Requirements of Local Authorities having Jurisdiction

O. Requirements of American Disabilities Act (Public law 101-336).

P. Texas Accessibility Standards (TAS)

Q. Texas Insurance Code.

1.4 QUALITY ASSURANCE

A. System Installer Qualifications:
   1. The System Installer shall be the authorized representative of the Access Control Manufacturer to sell, install, and service the proposed manufacturer's equipment. The System Installer shall have represented the security alarm manufacturer's product for at least two years.
   2. The System Installer shall be licensed as required, by the State in which the project is located in, as a security services contractor to design, sell, install, and service security alarm systems.
   3. The System Installer shall provide 24-hour, 365 days per year emergency service with factory trained service technicians.
   4. The installing firm shall have personnel on their staff that has been actively engaged in the business of designing, selling, installing, and servicing security alarm systems for at least ten (10) years.
   5. 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 access control system. No person is allowed to work on the system without proper manufacturer's certification.
   6. The proposing System Installer for this system and the installer of this system shall be of the same organization. Absolutely no subcontracting of any portion of this system by the proposing System Installer will be allowed.
   7. The proposing/installing contractor of this system must be an authorized

dealer / integrator for the project's specified Video Surveillance and the Intrusion Detection systems as well as the system specified in this section.

8. For proper, smooth, and complete integration of the IP security camera, access control, and intrusion detection systems; the proposing/installing contractor of the video surveillance and intrusion detection systems must be the same contractors.
9. The System Installer must be a current integrator of solution in the closest major metropolitan area marketplace, have a permanent office located within 75-miles of the project, and be able to include information on current support staff to be able to service this client.
10. The System Installer must be in good standing with the Owner and have no outstanding performance or warranty items at the time of bid. Any outstanding items or issues is grounds to disqualify the System Installer for performing any work on the project.

1.5 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.

1.6 DEFINITIONS

A. Abbreviations:

1.	ACS	Access Control System
2.	VMS	Video Management System
3.	NVR	Network Video Recorder
4.	IDS	Intrusion Detection System
5.	GUI	Graphical User Interface
6.	IP	Internet Protocol
7.	CR	Card Reader
8.	DS	Door Station
9.	MS	Master Station
10.	PIR	Passive Infrared Sensor
11.	LD	Lockdown
13.	LO	Lockout
14.	MDF	Main Distribution Frame
15.	IDF	Intermediate Distribution Frame

B. Definitions:

1. Access Card: A coded employee card, usually the size of a credit card, recognizable to the access control system and read by a reader to allow access. It can be used for photo identification of the cardholder and for other data collection purposes. Card technologies include magnetic strips, Wiegand-effect, proximity (active/passive), barium ferrite, smart/intelligent cards, and NFC enabled applications on mobile devices.
2. Access Control System: An interconnected set of controllers, managing the entrance and exit of people through secured areas.
3. Access Level: The door or combination of doors and/or barriers an individual is authorized to pass through and the times they are permitted.
4. Anti-Pass back (Anti-Tailgating): This feature protects against more than one

person using the same card or number. It defines each system card reader and card ID number as IN, OUT or other. Once a card is granted access to an IN reader, it must be presented to an OUT reader before another IN reader access is granted. Cards will continue to have access to all authorized OTHER readers.

5. Alarm: A signal that indicates a problem.
6. Alarm input: A device that is monitored by the access control panel. An alarm signal will be generated if the device is activated.
7. Badge: Badge is a template or a design for creating a card. DNA Fusion includes a full-featured badge layout utility for designing, creating, and printing badges. Badge design includes magnetic stripe encoding, bar coding, signatures, and so on.
8. Bar Code: A method of encoding information using lines and blank spaces of varying size and thickness to represent alphanumeric characters.
9. Biometrics: A general term for the verification of individuals using unique biological characteristics (i.e. fingerprints, hand geometry, voice analysis, the retinal pattern in the eye).
10. Card and Card Holder: A card is an identity proof of a person and a card holder is a person who holds the card. Multiple cards can be assigned to a single card holder to provide different access.
11. Controller: A microprocessor-based circuit board that manages access to a secured area. The controller receives information that it uses to determine through which doors and at what times cardholders are granted access to secure areas. Based on that information, the controller can lock/unlock doors, sound alarms, and communicate status to a host computer.
12. Card Reader: A device that retrieves information stored on an access card and transmits that information to a controller.
13. Digital Video Recorder: A security system device that records the video from the surveillance cameras (IP and Analog) on a hard disk.
14. Door: A generic term for a securable entry way. In many access control applications, a "door" may be a gate, turnstile, elevator door, or similar device.
15. Duress: Forcing a person to provide access to a secure area against that person's wishes.
16. Input: An electronic sensor on a controller that detects a change of state in a device outside the controller.
17. Integrated lockset: An integrated, intelligent locking solution that typically runs on batteries, but can be externally powered, that contains most of the door components, i.e. reader, door contact, and request to exit in a single, mountable unit.
18. Keypad: An alphanumeric grid which allows a user to enter an identification code. A flat device which has buttons that may be pressed in a sequence to send data to a controller, and which differs from a typewriter-like computer keyboard.
19. Output Relay: A device that changes its state upon receiving a signal from a controller. Typically, the state change prompts an action outside of the controller such as activating or deactivating a device. The auxiliary relays found in access control panels or NODES that control external devices.
20. Shunt Time: The length of time a door open alarm is suppressed (shunted) after a valid card access or free egress request. This time should be just enough to allow a card user to open a door or gate, pass through, and then close it.
21. Time Schedules: Schedules that allow cards to function or not function depending on the time of day. This is used to limit access to the facility. The schedule may include not only time but which days of the week a card is valid.
22. Video Management System: An enterprise-class video management and

storage solution

1.7 PRE-INSTALLATION MEETINGS

A. No less than a minimum of two weeks prior to rough-in or installation of any access control device, the ACS Installer will be required to attend a pre-construction meeting with the Door Hardware provider / installer to aid in coordination and help avoid gap / overlap during the installation phase.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.

B. Handling: Handle materials to avoid damage.

1.9 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.10 SEQUENCING

A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.11 WARRANTY

A. The ACS furnished by the System Integrator including wiring, software, hardware and third-party products shall be fully warranted for parts, materials and labor for a minimum of 1 year from date of the final acceptance.

B. Manufacturer shall provide a limited 3-year warranty for the product to be free of defects in material and workmanship.

PART 2 - PRODUCTS

2.1 Reference Attachment ‘A’ of this specification for supplemental scope and product material list as it relates to the project and the Owner standards

2.2 MANUFACTURERS

A. Approved Manufacturers:
1. AMAG Technology Inc.
20701 Manhattan Place
Torrance, Ca 90501
(310).518.2380
http://www.amag.com

B. Requests for substitutions will be considered in accordance with provisions of Division 1. In the absence of direction by Division 1, substitution request must be submitted no less than ten (1) business days from the time of proposal. Any substitution proposed will have to be proposed as a complete system replacement across the Owner’s entire platform, including any cabling and/or hardware changes required to convert all of the

Owner's existing sites.

2.3 SERVERS AND USER INTERFACE

A. Servers and Unser Interfaces are existing to remain. The system installer shall coordinate the installation of all new equipment and/or existing equipment that is affected by the project's scope. All equipment shall be modified and/or added in compliance with the existing systems parameters. The system installed shall provide and additional equipment to furnish a complete expansion of the system as shown on the project drawings, access control schedule, details, and legends.

2.4 ACCESS CONTROL SYSTEM (ACS)

A. General: The ACS is a modular and networked based system providing physical access control security to a Wide Area campus enterprise. The system shall be capable of controlling and integrating multiple security functions including the configuration, management and monitoring of cardholder access, locking hardware units, events, alarms, visitors, and real-time tracking and reporting. The ACS is to be alterable at any time depending on the facility requirements and will allow for easy upgradeability or modification of network processors, controller, interface modules, card data, inputs, outputs, and remote workstations. The ACS shall include, but is not be limited to, the following:

1. Client/Server model operating central server host software modules and client workstation software applications in a multi-user and a multi-tasking environment.
    a. The ACS to permit multiple instances of client software applications to run simultaneously on the network. The base system shall include one (1) software application licenses per site with an unlimited number of licenses available subject to connection fees.
2. Partitioning: The system to support security partitioning enabling system administrator to segment the configuration database and group multiple entities within the security partition.
    a. Security partitions limit what users can view in the configuration database. Administrators, who have all rights and privileges, can segment a database into multiple security partitions. A user who is given access to a specific partition will only be able to view entities (components) within the partition they have been assigned.
3. Encryption: The system to support encrypted communication between the central server software and client software applications (sever-to-server and client-to-server) using a 128-bit AES encryption algorithm (at a minimum).
    a. Communication between the central server host software module and system controllers to be encrypted if supported by the controllers.
    b. The ACS client software applications to be password protected with passwords stored in the central server database in an encrypted manner.
4. Distributed Processing: The system is a fully distributed processing application allowing information, including time, date, zones, valid codes, tasks, access levels, and similar data, to be downloaded from the central host station to controller interface devices allowing access-control decisions with or without central host station communication. If communications to a central host station are lost, the controllers will automatically buffer event transactions until communications are restored and events are automatically uploaded to the central host station.
    a. Provide for a higher level of distributed database management at defined perimeter access points such that no single point of failure

will allow more than two access points to fail, or affect more than two access points at perimeter points system wide.

5. Single Data Base: The system to support a single database for access control site setup, credential and identity file creation, alarm and control setup, and system user operation and command functions.
6. System Access Management: The system to allow operators through password authentication the ability to make access granted or denied decisions, define access levels, time zones, holidays, assign cardholders, access groups, develop tasks, and generally manage access control, alarm monitoring and response activities system wide from a single login. Operator and user privileges are managed by a system administrator allowing for different levels of system access and system control. Authorization management is fully Owner definable.
7. Cardholder Management: The system to include a cardholder management system integrated within the access control system. This cardholder management functionality allows the enrollment of cardholders into the database, and import / export of employee data.
8. Access Groups and Access Levels: The system to provide adequate access groups and access level assignment capability to meet Owner requirements for the specified project. If required, software application can be expandable to support unlimited access groups and access levels.
9. Alarm Monitoring: The system is able to monitor, report, and provide information about the time and location of alarms, along with their priority.
10. Event Monitoring: The system is able to monitor, report, and archive network access control activity.
11. Transaction Logs: The system to support an unlimited number of logs and historical transactions (events and alarms) with the maximum allowed being limited by the amount of hard disk space available.
12. System Monitoring: The system to have ability to report on the integrity of all network assigned devices, circuits and communications and provide a diagnostics screen showing field level communications system wide
13. Lock/Unlock Commands: The system to allow an operator to manually lock and unlock doors overriding scheduled access control restrictions and configurations if necessary.
14. Hardware Interface: The system to integrate with and control specified electrified hardware, signaling and monitoring devices.
15. Report Generator: The system to have the ability to generate and output reports with any and all combinations of system fields and data including, but not limited to: by cardholder, by door, by site, by time, by groups of doors and by cardholder field. Any and all combinations of fields must be available for reporting. The report feature to allow exporting of generated reports over a network connection or by remote printing.
16. Multi-User/Web Based Network Capabilities: The system to support multiple operator workstations via local area network/wide area network (LAN/WAN), the Internet, or VPN. The system to be capable of supporting minimum of concurrent users/clients with software expansions to an unlimited number of workstations based on the Owners network requirements.

B. Open Protocol: The ACS manufacturer to provide non-proprietary, open protocol hardware for the system control processors and associated device sub-controllers. Systems utilizing a single manufacturer solution that encompasses combined proprietary software and integrated electronic hardware combinations are not acceptable. In addition, integrated electronic locking hardware requiring a processor or sub-controller module upgrade, or extensive access control firmware upgrades to accommodate integrating with an alternate software package, will not be considered.

C. Network Support: Communication network connecting the central server host software modules, client workstation software applications, and hardware controllers to be designed to support all of the following:
   1. LAN/Ethernet enterprise ring topology and localized star topology based on TCP/IP.
   2. Direct-connected RS-232 and RS-485 communication cabling.
   3. Dial-up modem connection using a standard dial-up telephone line.

D. Provide local communication port at each panel for local configuration of system with laptop.

E. Locate all main control panels in MDF and IDF rooms of each building.

F. Provide 120v at all controller and power supply locations.

G. Provide and transfer all required licensing to the owner.

H. Provide local communication port at each panel for local configuration of system with laptop.

I. Integrated Elevator Destination Dispatch Control Solutions
   1. The ACS shall provide means of integration with the following elevator systems destination dispatch control solution. Integration shall be by software or input/output connection (software, if available between the specified ASC and Elevator System):
      a. Otis
      b. Krone
      c. Thyssen-Krupp
   2. The destination dispatch control solution shall provide the following functions:
      a. Provide card reader security within the elevator(s) as required.
      b. Provide card reader security at the Destination Dispatch kiosk(s), as required.
      c. Allow Default Floor call registration upon card swipe.
      d. Allow for card flags such as VIP and ADA from a card swipe
      e. Enforce elevator access levels

2.5 ACCESS CONTROL PANEL HARDWARE

A. Reference Attachment ‘A’

B. System Back-Up Battery: The System Installer shall provide backup batteries as required to furnish ninety (90) minutes of run time to the complete system, including but not limited to lock power and system power.

2.6 FIELD DEVICES

A. General: Coordinate with door hardware and access control schedule as to whether each access control portal is wireless or directly connected to a control panel. Provide all Controllers, Sub-Controllers, and licensing as required to connect all card reader locations shown on plan.

B. Card Readers: Provide card readers as shown on the floor plans, access control schedule, and access control details.

C. Credentials: Coordinate Facility Code, External Start Number, and Internal Start number with the Owner prior to procuring credentials.

D. Miscellaneous Devices: Provide the following devices as designated per the project floor plans, access control schedules, and access control details:
   1. DP/DT Door Position Sensors (Door Contacts)
   2. PIR Motion Request to Exit Sensor
   3. Lockdown Buttons
   4. Door Release Buttons
   5. Video Intercom Door Stations (Provide and Install per drawings and Division 28 Audio / Video Intercom specification)
   6. Video Intercom Master Stations (Provide and Install per drawings and Division 28 Audio / Video Intercom specification)

2.7 WIRING

A. All cable associated with the ACS shall be purple in color.

B. Ethernet cabling to access control panels shall be as specified in the Structured Cabling System (SCS) specifications and shall be provided by the SCS Installer. In the event that there is not SCS installer on the project, cabling shall be provided and installed by the ACS Installer and shall comply with the Division 27 SCS specification, minimum of Category 6A cable shall be utilized if not specified otherwise.

C. Provide cabling and connections for all access control doors in this scope, existing and new. Conventional access control cable shall be a jacketed composite cable. The minimum conductor requirement shall be as follows:
   1. Standard
      a. Lock Power: 4-conductor, 18AWG, shielded
      b. Card Reader: 6-conductor, 22AWG, OA shielded
      c. Door Contact: 2-conductor, 22AWG, shielded
      d. Request to Exit/Spare: 4-conductor, 22AWG, shielded
   2. Extended Distance
      a. Lock Power: 4-conductor, 16AWG, shielded
      b. Card Reader: 6-conductor, 18AWG, OA shielded
      c. Door Contact: 2-conductor, 18AWG, shielded
      d. Request to Exit/Spare: 4-conductor, 18AWG, shielded

D. Wire scheme and conductor quantity shall be as required by the manufacture’s specifications. The System Installer to provide and install shielded cable as required.

E. All 120v Power shall be furnished by the Division 26 contractor. In the event that a division 26 contractor is not contracted for the project, the system installer shall contract a licensed electrical firm to provide and install all materials required to furnish a complete and operational system.

F. All Security Conduit as required for a complete installation of this system shall be furnished by the division 26 contractor as part of their scope of work. In the event that a division 26 contractor is not contracted for the project, the system installer shall provide and install all conduit required.

G. Coordination with the Division 26 contractor is the responsibility of the ACS Installer to ensure all conduit is in place for a complete installation.

H. All systems shall be connected to a dedicated circuit and on an emergency power

source if available.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All wiring shall be in accordance with the National Electrical Code, Local Codes, and article 760 of NFPA Standard 70. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings.

B. All wire shall be UL Listed CL2 for limited energy (300V) applications and shall be installed in conduit. Limited energy MPP wire may be run open in return air ceiling plenums provided such wire is UL Listed for such applications and is of the low smoke producing fluorocarbon type and complies with NEC Article 760 if so, approved by the local authority having jurisdiction.

C. No AC wiring or any other wiring shall be run in the same conduit as security alarm wiring.

D. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.

E. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.

F. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed or subject to damage.

G. All vertical wiring and all main trunk/riser wiring shall be installed in a complete raceway/conduit system. All riser boxes shall be adequately sized for the number of conductors transversing the respective box as well as the number of terminations required.

H. Network Connection Cable: Provide a 4 pair Category 6A data cable from the Master Control Panel to the MDF network rack. Category 6A cable shall be purple in color.

I. All plenum wiring is to be installed parallel and perpendicular to the building structure. Install wiring tight up against structure for protection. Cable shall be bundled on a maximum of 2'-6" and secured to the structure at a maximum of 5' on center. Bundling and support shall be with plenum rated cable ties.

J. System Installer is required to provide all mapping and software configuration required to operate system as per manufacturer’s recommendations.

3.2 CABLE PATHWAYS

A. Cable Support:
   1. All wire not installed inside conduit or a designated cable tray system shall be installed in a dedicated cable support system for the entire run of each cable. Including, but not limited to service loops.
      a. Approved Cable Support Product:
         1) Panduit
         2) Arlington

3) Caddy
4) Support system shall be sized appropriately for the number of wires being installed. Reference the manufacturer's specifications for the suggested maximum cables per support size.

2. The approved cable support system shall be attached directly to the building steel at a serviceable height. In the event that the building steel is not 5' of the finished ceiling, the system installer 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 system installer to coordinate with all other trades on the project to ensure that the pathway of this system does not interfere with the installation of the other trades and to prevent the installed product of other trades from putting strain on the installed wiring.

B. Conduit / Raceway:
1. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.
2. Conduit and raceway system shall be installed as specified under the general electrical section of the specifications, and per NEC.
3. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.
4. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed or subject to damage.
5. All conduit ends shall have a protective bushing to prevent cable damage. Bushings must be installed prior to installing cable. Cutting bushing to install around installed cables will not be accepted.

3.3 TESTING

A. Submit a written test report from an authorized representative of the equipment manufacturer that the system has been 100% tested and approved. Final test shall be witnessed by Owner and the project's Technology Consultant and performed by the equipment supplier. Final test report must be received and acknowledged by the Owner prior to substantial completion.

B. Provide instruction as to proper use and operation of system, for the Owner's designated personnel.

3.4 WARRANTY

A. Entire system shall be warranted against defects in materials and workmanship for a period of one (1) year from the date of substantial completion.

3.5 SOFTWARE

A. Provide two electronic copies of the final programming and program software to the Owner's Security Supervisor after final approval.

ATTACHMENT 'A'

PROJECT SPECIFIC SCOPE OF WORK AND EQUIPMENT LIST

PART 1 – PROJECT SCOPE

1.1 DESCRIPTION OF WORK

A. This project is an expansion of an existing access control system and consists of the provision and installation of a complete and functional Access Control System (ACS) as required to furnish controlled access and access detection to all controlled portals identified on the project drawings. This project is an elementary school renovation for the Cypress-Fairbanks Independent School District.

B. It should not be assumed that any portions of a complete and functional system are to be furnished and/or provided by anyone, other than the ACS installer, unless specifically stated otherwise.

PART 2 – EQUIPMENT LIST

2.1 The ACS installer shall perform no portion of the work requiring submittal and review of record drawings, shop drawings, product data, or samples until the respective documentation has been approved by project's Security Consultant.

2.2 VESTIBULE ACCESS CONTROL PANEL

A. All hardware is to be mounted in an Altronix Trove 2 enclosure with RSB2 switch plate located in the nearest IDF to the main entry vestibule.

B. One (1) Intelligent Door Controller and door SubControllers shall be populated in the Altronix enclosure sufficient to provide access controls for all doors to be controlled from the IDF, for a minimum of eight (8) doors. The Intelligent Controller shall be IP-based. SubControllers should connect to the Intelligent Controller via network or RS-485 Data Bus.

C. An Altronix eFlow 10XNB power supply is required to be provided and installed along with a PDS8CB or PD16W Power Distribution Module and ACM8CB Access Power Controller. A (1) VR6 regulator in the enclosure to provide correct power distribution.

D. Panel must have a provided emergency power circuit to the R2B2 switch panel to enable ease of power shut off for the power supply by one switch and main panel transformer on the secondary switch.

E. Two Category 6A network drops are required within the panel for local configuration of system with laptop and primary panel communication. Each drop should be properly labeled per network cabling guidelines.

F. Panel IP network configuration information shall be provided by the owner.

G. All vestibule doors are to be wired back to this main panel with approved composite access control cable and terminated in the following order
    1. Front Entry Door- Reader 1 -24VDC/12VDC output 1
    2. Reception Entry Door- Reader 2 -24VDC/12VDC output 2
    3. Vestibule Exit Door- Reader 3 -24VDC/12VDC output 3
    4. Reception Exit Door- Reader 4 -24VDC/12VDC output 4

H. Final software configuration / programming of system integration will require owner and system installer consultation.

I. Vestibule Access Control Panel shall not be limited to provide access control power and controllers to the vestibule only, but shall be available for other controlled doors in the area of influence of that IDF.

2.3 PERIMETER AND INTERIOR DOOR CONTROL PANELS

A. Door Control Panels are to be installed as needed in MDF/IDF rooms throughout the campus, to provide communications and power for access control devices in the area of influence of each IDF.

B. All hardware is to be mounted in an Altronix Trove 2 enclosure with RSB2 switch plate. Panel must have a provided emergency power circuit to the RB2 switch panel to enable ease of power shut off for the power supply by one switch and main panel transformer on the secondary switch.

C. One (1) Intelligent Door Controller and door SubControllers shall be populated in the Altronix enclosure sufficient to provide access controls for all doors to be controlled from the IDF, for a minimum eight (8) doors. The Intelligent Controller shall be IP-based. SubControllers should connect to the Intelligent Controller via network or RS-485 Data Bus.

D. An Altronix eFlow 10xNB power supply is required to be provided and installed along with a PDS8CB or PD16W Power Distribution Module and ACM8CB Access Power Controller. A (1) VR6 regulator in the enclosure to provide correct power distribution.

E. Two Category 6 network drops are required within the panel for local configuration of system with laptop and primary panel communication. Each drop should be properly labeled per network cabling guidelines.

F. Panel IP network configuration information shall be provided by the owner.

G. Final software configuration / programming of the system integration will require owner / contractor consultation.

2.4 VEHICLE ACCESS GATES

A. Access Controlled gates shall be connected to an IP-based 2-Door controller which may be installed near the building perimeter wall, closest to the gate, to provide additional cabling distance.
B. 2N IP Verso Video Intercom (w/ Wiegand and Prox Reader module) to be installed on pedestal housing for access control entry through controlled vehicle gate.
C. All gates must have a Tagmaster XT-1 RFID reader installed as the secondary for utilization of district vehicle tag system.
D. Consultation is required with the owner to determine is additional Vehicle Tags will be required at the time of installation and the amounts needed.

2.5 FIELD DEVICES

A. Card Access Equipment
   1. All Card Readers locations to be installed on walls or pedestrian gates shall be PR10 card readers as manufactured Schlage.
   2. All Card Readers locations to be installed on doors shall be Harmony series readers as manufactured by Sargent.
   3. Access Control contractor shall provide ALL electronic components required for a complete and functioning access control system, to include card reader, door contact, lock power supply, electrified locking device with integrated request to exit, power transfer hinge and wiring harnesses. The door hardware contractor shall be responsible for non-electrified, mechanical door hardware.

4. Access Control contractor shall provide all cabling required for connection to any device incorporated and not incorporated in door hardware.
5. Contractor shall provide 300 HID proximity cards 1386 Series for this campus. CFISD has a Corporate 1000 account set up with HID. The contractor shall purchase cards through HID using this account to ensure card numbers and facility numbers are followed.
6. Provide Ethernet Network Interface to connect school to district-wide access control system. Connect to local area network at each facility.
7. Contractor shall provide all cabling and accessories required to provide complete access control solution and proper integration with building intrusion alarm system for door contact shunting.
8. Provide all door controllers as required to connect all perimeter card reader locations shown on plan plus one additional of each type for attic stock.

2.6 WIRING

A. Access Control Contractor shall provide and install Access Control system cabling.
1. Color code of all security intrusion detection system an access control wiring shall be purple in color.
Approved products: Lake Composite Access Control Cable: S800081709-07
2. Reference Specification Section 27 10 00 Technical Cabling and Section 28 16 00 Intrusion Detection for cable types.
3. All systems shall be connected to an emergency power source as available.
4. All 120v Power and system conduits as shown on the drawings shall be furnished by a licensed electrical contractor as part of their scope of work.
5. Coordination with the electrical contractor is the responsibility of the Security contractor to ensure all conduit is in place for a complete installation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All wiring shall be in accordance with the national Electrical Code, Local Codes and article 760 of NFPA Standard 70. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings.

B. All wire shall be UL Listed CL2 for limited energy (300V) applications and shall be installed in conduit. Limited energy MPP wire may be run open in return air ceiling plenums provides such wire is UL Listed for such applications and is of the low smoke producing fluorocarbon type and complies with NEC Article 760 if so approved by the local authority having jurisdiction.

C. No AC wiring or any other wiring shall be run in the same conduit as security alarm wiring.

D. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC

and the local authority having jurisdiction). Maximum conduit “fill” shall not exceed 40% per NEC.

E. Minimum conduit size shall be 3/4” EMT. Install conduit per engineered shop drawings.

F. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed or subject to damage.

G. All vertical wiring and all main trunk/riser wiring shall be installed in a complete raceway/conduit system. All riser boxes shall be adequately sized for the number of conductors traversing the respective box as well as the number of terminations required.

H. Network Connection Cable: Provide a Category 6 data cable from the Master Control Panel/Node to the MDF network rack. Category 6 cable shall be purple in color.

I. All plenum wiring is to be installed parallel and perpendicular to the building structure. Install wiring tight up against structure for protection. Cable shall be bundled on a maximum of 2'-6" and secured to the structure at a maximum of 5' on center. Bundling and support shall be with plenum rated Velcro ties and J-Hooks. (Ref. 28-13-00 3.3A)

J. Contractor is required to provide all mapping and software configuration required to operate system as per manufacturer's recommendations.

3.2 CABLE PATHWAYS

A. Cable Support:
   1. All wire not installed inside conduit or a designated cable tray system shall be installed in a dedicated cable support system for the entire run of each cable. Including but not limited to service loops.
      a. Approved Cable Support Product:
         PANDUIT ® Corporate J-MOD TM modular support system (sized appropriately for the number of wires being installed. Reference the manufacturer's specifications for the suggested maximum cables per support size).
   2. The approved cable support system shall be attached directly to the building steel at a serviceable height. In the event that the building steel is not 5' of the finished ceiling, the contractor shall provide a dedicated threaded rod extending within 5' of the finished ceiling and mount the J-MOD TM support hook to the threaded rod.
   3. J-MOD TM cable support shall be installed at a maximum of 5' on center.
   4. All cable installed shall be attached to the J-MOD TM support system with plenum rated Velcro and a plenum rated Velcro tie shall be installed between each J-MOD TM cable support to keep wires neatly bundled throughout the entire run. Tiewraps will only be allowed to be used inside the control panels as required to manage the wires within each type of panel.
   5. ABSOLUTELY NO CABLE, NOT INSTALLED IN CONDUIT, WILL BE ALLOWED TO BE ATTACHED DIRECTLY TO THE BUILDING'S STEEL OR SUPPORTED IN ANY OTHER METHOD THAN THAT STATED ABOVE.
   6. IT IS THE RESPONSIBILITY OF THE INSTALLING CONTRACTOR TO COORDINATE WITH ALL OTHER TRADES ON THE PROJECT TO ENSURE THAT THE PATHWAY OF THIS SYSTEM DOES NOT INTERFERE WITH THE INSTALLATION OF THE OTHER TRADES AND TO PREVENT THE INSTALLED PRODUCT OF OTHER TRADES FROM PUTTING STRAIN ON THE INSTALLED WIRING.

B. Conduit / Raceway
   1. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.
   2. Conduit and raceway system shall be installed as specified under the general

electrical section of the specifications, and per the NEC.

3. Minimum conduit size shall be 3/4” EMT. Install conduit per engineered shop drawings.
4. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed or subject to damage.
5. All conduit ends shall have a protective bushing to prevent cable damage. BUSHINGS MUST BE INSTALLED PRIOR TO INSTALLING CABLE. CUTTING BUSHING TO INSTALL AROUND INSTALLED CABLES WILL NOT BE ACCEPTED.

3.3 TESTING

A. Submit a written test report from an authorized representative of the equipment manufacturer that the system has been 100% tested and approved. Final test shall be witnessed by Owner, Engineer, Electrical Contractor, Door Hardware Installer, 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 the system, for the Owner’s designated personnel.

3.4 WARRANTY

A. Entire system shall be warranted against defects in materials and workmanship for a period of one (1) year from the date of substantial completion.

B. Installed main system devices must be awarded the same warranty provided to the installer by the Manufacturer of the product.

3.5 SOFTWARE

A. Provide two electronic copies of the final programming and program software to the Owner’s Security Supervisor after final approval.

END OF SECTION

SECTION 28 10 00.05

AUDIO / VIDEO INTERCOM (IP)

PART 1 - GENERAL

1.1 RELATED WORK

A. The following, in their entirety and as applicable, shall apply to this section. Including any associated drawings.
   1. Conditions of the Contract
   2. Division 1
   3. Division 26
   4. Division 27
   5. Division 28

1.2 SYSTEM DESCRIPTION

A. General Requirements:
   1. The specified unit shall be of manufacturer's official product line, designed for commercial and/or industrial 24/7/365 use.
   2. The specified unit shall be based upon standard components and proven technology using open and published protocols.

B. Sustainability
   1. The specified unit shall be manufactured in accordance with ISO 14001.
   2. The specified unit shall be compliant with the EU directives 2011/65/EU (RoHS) and 2012/19/EU (WEEE).
   3. The specified unit shall be compliant with the EU regulation 1907/2006 (REACH).

1.3 CERTIFICATIONS AND STANDARDS

A. General abbreviations and acronyms
   1. AES: Advanced Encryption Standard
   2. API: Application Programming Interface
   3. Bit Rate: The number of bits/time unit sent over a network
   4. DHCP: Dynamic Host Configuration Protocol
   5. DNS: Domain Name System
   6. FPS: Frames per Second
   7. FTP: File Transfer Protocol
   8. H.264 (Video Compression Format)
   9. IEEE 802.1x: Authentication framework for network devices
   10. IP: Internet Protocol
   11. IR light: Infrared light
   12. ISO: International Standards Organization
   13. JPEG: Joint Photographic Experts Group (image format)
   14. LAN: Local Area Network
   15. LED: Light Emitting Diode
   16. MPEG: Moving Picture Experts Group
   17. Multicast: Communication between a single sender and multiple receivers on a network
   18. NTP: Network Time Protocol
   19. ONVIF: Global standard for the interface of IP-based physical security products
   20. PACS: Physical Access Control System
   21. PoE: Power over Ethernet (IEEE 802.3af/at) standard for providing power

over network cable
22. Progressive scan: An image scanning technology which scans the entire picture
23. QoS: Quality of Service
24. RPC: Remote Procedure Call
25. SIP: Session Initiation Protocol
26. SMTP: Simple Mail Transfer Protocol
27. SNMP: Simple Network Management Protocol
28. SSL: Secure Sockets Layer
29. TCP: Transmission Control Protocol
30. TLS: Transport Layer Security
31. Unicast: Communication between a single sender and single receiver on a network
32. UPS: Uninterruptible Power Supply
33. VBR: Variable Bit Rate
34. VMS: Video Management System
35. WDR: Wide dynamic range

B. The specified unit shall carry the following EMC approvals:
1. EN55032: 2012
2. EN55024: 2010
3. 2014/35/EU
4. 2014/30/EU
5. 2012/19/EU
6. 2011/65/EU
7. EN 55032 Class A
8. EN 55032 Class B
9. EN 55024
10. FCC Part 15 - Subpart B Class A
11. FCC Part 15 - Subpart B Class B
12. FCC Part 15 - Subpart B Class A + B
13. ICES-003 Class A
14. ICES-003 Class B

C. The specified unit shall meet the following product safety standards:
1. IEC/EN/UL 60950-1

D. The specified unit shall meet the following standards
1. Audio:
   a. G.711
   b. G.729
   c. G.722 (wideband)
   d. L16 / 16kHz (wideband)
2. Video:
   a. H.263+
   b. H.263
   c. H.264 (MPEG-4 AVC)
   d. MPEG-4 Part 2
   e. MJPEG
3. Networking:
   a. IEEE 802.3af/802.3at (Power over Ethernet) [applies to products with PoE]
   b. IEEE 802.1X (Authentication)
   c. IPv4 (RFC 791)
   d. QoS
4. Mechanical Environment:

a. IEC/EN 60529 IP54
b. IEC/EN 62262 IK08

1.4 QUALITY ASSURANCE

A. Contractor Qualifications:

1. The system installer shall be the authorized representative of the manufacturer to sell, install, and service the proposed manufacturer's equipment. The system installer shall have represented the security alarm manufacturer's product for a minimum of five (5) years' with experience installing and servicing systems of similar scope and complexity and evidence that is completed at least three (3) projects of similar design and is currently engaged in the installation and maintenance of systems herein described.
2. The system installer shall be licensed as required, by the State in which the project is located in, as a security services contractor to design, sell, install, and service security alarm systems.
3. The system installer shall provide 24-hour, 365 days per year emergency service with factory trained service technicians.
4. The installing firm shall have personnel on their staff that has been actively engaged in the business of designing, selling, installing, and servicing security systems for at least ten (10) years.
5. The proposing contractor for this system and the installing contractor of this system shall be of the same organization. Absolutely no subcontracting of any portion of this system by the proposing contractor will be allowed.
6. The proposing/installing contractor of this system must be an authorized dealer / integrator for the project's specified Access Control, Video Surveillance and the Intrusion Detection systems as well as the system specified in this section.
7. Contractor must be a current integrator of solution in the closest major metropolitan area marketplace, have a permanent office located within 75-miles of the project, and be able to include information on current support staff to be able to service this client.
8. All installation, configuration, setup, program and related work shall be performed by electronic technicians thoroughly trained by the manufacturer in the installation and service of the equipment provided.
9. The system installer shall submit credentials of completed manufacturer certification, verified by a third-party organization, as proof of the knowledge.
10. The Contractor shall provide four (4) current references from clients with systems of similar scope and complexity that became operational in the past three (3) years. At least three (3) of the references shall be utilizing the same system components, in a similar configuration as the proposed system
11. Contractor must be in good standing with the Owner and have no outstanding performance or warranty items at the time of bid. Any outstanding items or issues is grounds to disqualify the Contractor for performing any work on the project.

B. System Qualifications:
1. The specified unit shall be manufactured in accordance with ISO9001.

1.5 SUBMITTALS AND CLOSE-OUT

A. Product Data:
1. Within fourteen (14) days of Notice to Proceed, the system installer shall furnish the following in a single consolidated submittal:
a. Permits: The Contractor shall obtain all required permits and provide

copies to the Owner / Architect / Engineer.

b. Product Literature: Complete manufacturer's product literature for all system equipment, power supplies, cable, termination components, cable supports, cable labels, field devices, and other products to be used in the installation. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner/Designer) and the manufacturer's supporting documentation, demonstrating compatibility with other related products shall be included. The submittal shall have some type of distinguishing marker or pointer to indicated what specific product is to be submitted.

c. Construction Schedule: A time-scaled Construction Schedule indicating general project deadlines and specific dates relating to the installation of the cable distribution system.

d. Specification Compliance: A letter shall be provided stating, by section and subsection, that the system installer complies with the ENTIRE specification section. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been accepted by the project's technology consultant.

e. Certifications: The contractor shall submit all of the following certifications and the certifications must contain dates which are valid from the date of proposal and not expirer any sooner than 12 months after substantial completion of the project.

1) Manufacturer's Authorized Dealer/Installer Certification: This certification must be held by the proposing/installing contractor and state that the proposing/installing contractor is and authorized dealer/installer of the system specified within the project specifications. The certification must have been obtained by the office that is within a 75-mile radius of the project's location.

2) Installer Certification: This certification must be held by at least 25% of the, on-site, staff and be made available at the site if requested by the owner, architect, and/or project's technology consultant.

3) Licenses: This includes all licenses required by the state in which the work is being performed, the federal government, local authorities having jurisdiction, and any organization in that governs the specific system

B. Shop Drawings:

1. Submit the following items, for Owner review and approval, within twenty-eight (28) days of notice to proceed:

a. Proposed circuit routing and circuit grouping plan prepared by a system registered designer. The designer's certification must be current. Identifiable, separate routing shall be shown for both the station cabling and any backbone trunk cabling.

b. In addition to the cable routing, the submitted drawings shall indicate the following, even if the following is expected to be provided by the project's electrical or general contractor:

1) Location of all control equipment and remote power sources

2) Locations of all field devices and outlets

3) Location of wall penetrations (all penetrations shall be sleeved and contain protective bushings at both ends)

4) Location of sleeved wall and/or floor pass-thru

5) Size of sleeve at each location installed
6) Quantity of cable passing through each sleeve
7) Conduit routing, size, quantity, and stub-up locations for any floor mounted outlets or outlets installed in casework.

c. Drawing Compliance: A letter shall be provided stating that the system installer complies with the entire project drawing, including all general, keyed, and notes to contractor. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been approved by the project's technology consultant.

C. Close-out Procedures: 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 Contractor shall maintain an adequate inspection system to ensure that the materials supplied, and the work performed, conform to contract requirements. The Contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion.
2. 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 fulfil 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 labelled 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. Contractor shall provide one complete floor plan sheet at each panel location.

1.6 WARRANTY

A. All security system components and labor furnished by the contractor including wiring, software, hardware and custom parts shall be fully warranted for parts, materials, labor and travel expenses for a minimum of three (3) years start from the date of substantial completion.

B. The manufacturer shall provide warranty and optional extended warranty for the unit for a total period of maximum five years. If enacted as part of the contract, the contractor will repair or replace parts and/or labor per the warranty for the length of this warranty at no cost to the client.

PART 2 - PRODUCTS

2.1 GENERAL

A. Intercoms shall be IP-based and comply with established network and video standards.

B. Intercoms shall be powered by the switch utilizing the network cable.

C. Intercoms shall be fully supported by an open and published API (Application Programmers Interface), which shall provide necessary information for integration of functionality into third party applications.

2.2 INTERCOM SCHEDULE

A. Intercom types listed below describing various resolutions, form-factor and features shall be supplied by a single intercom manufacturer.

B. The intercom manufacture and model numbers will be as follows:
   1. Modular IP intercom shall be 2N IP Verso with camera. Part # 02907-001
   2. IP intercom base station shall be 2N Indoor View. Part # 02088-001
      a. 2N Base station stand required. Part # 02039-001
   3. 2N Combo Reader Module. Part # 016939-001
   4. 2N Secure Door Set Tamper. Part # 01975-001
   5. 2N Weigand Module. Part # 01259-001
   6. 2N Surface frame plate. Part # 01289-001
   7. 2N Surface back plate. Part # 01294-001

2.3 INTERCOM

A. Modular IP intercom
   1. The intercom shall meet or exceed the following design specifications:
      a. Intercom shall include a built-in web server.
      b. Intercom shall be able to perform defined local access control functionality without being connected to the network.
      c. Intercom shall be of modular design, include a replaceable front-end frame, providing 1 or 2 additional slots for functional modules, and

should support multiple frames stacked side by side. The intercom shall support at least 29 functional modules when fully expanded.

d. Intercoms' main unit shall be available with and without camera, and shall support the following functional modules:
   1) ID card reader
   2) Fingerprint reader
   3) Keypad
   4) Button module
   5) Touch screen
   6) Bluetooth
   7) Wiegand interface

e. The intercom shall be equipped with an IR-sensitive progressive scan megapixel sensor and be able to provide images also under dark conditions.

f. The intercom shall be equipped with built-in power adaptive IR-illumination/LED.

g. The camera shall provide an automatic IR-cut filter, providing day/night functionality.

2. The intercom shall meet or exceed the following performance specifications:
   a. Video
      1) The intercom shall provide video streams in 640x480 at up to 30 frames per second using H.264, H.263, H.263+ or up to 15 frames per second using MJPEG.
      2) The intercom camera shall provide images in resolutions up to 1280x960.
      3) The intercom shall support the following video encoding algorithms:
         a) H.263+
         b) H.263
         c) H.264
         d) MPEG-4 Part 2
         e) MJPEG
      4) The intercom shall provide independently configured simultaneous H.264 and MJPEG streams.
      5) The intercom shall in H.263, H.263, H.264 support Constant Bit Rate (CBR) to protect the network from unexpected bit rate peaks.
      6) The intercom shall provide configurable compression levels.
      7) Support standard baseline profile H.264 with motion estimation.
      8) Support motion estimation in H.264/MPEG-4 Part 10/AVC.
      9) The intercom shall allow for video to be transported over:
         a) HTTP (Unicast)
         b) HTTPS (Unicast)
         c) RTP (Unicast & Multicast)
         d) RTP over RTSP (Unicast)
         e) RTP over RTSP over HTTP (Unicast)
      10) The intercom shall support Quality of Service (QoS) to be able to prioritize traffic.
   b. Image
      1) The camera shall incorporate automatic white balance.
      2) The camera shall support manually defined values for:
         a) Color level
         b) Brightness
   c. Audio
      1) The intercom shall support two-way full duplex audio:

a) Input sources
(1) Internal microphone
b) Output sources
(1) Built-in speaker, 2W
(2) Line out

2) The intercom shall support separately adjustable volume levels for:
a) Call
b) Key
c) Ring tones
d) Preloaded audio clips
e) Warning tones
f) Paging

3) The intercom shall support adaptive gain control.

4) Encoding
a) The intercom shall support:
(1) G.711
(2) G.722 (wideband)
(3) G.729
(4) L16 / 16kHz (wideband)

5) The intercom shall provide a sound pressure level of at least 78dB at 1kHz at 1m.

6) The intercom shall be equipped with active echo cancellation.

7) The intercom shall allow for audio to be transported over:
a) RTP (Unicast & Multicast)
b) RTP over RTSP (Unicast)
c) RTP over RTSP over HTTP (Unicast)

8) The intercom shall support Quality of Service (QoS) to be able to prioritize traffic.

d. Call functionality

1) The intercom shall support SIP for integration with VoIP, peer-to-peer or integrated into SIP/PBX.

2. The intercom shall support the use of SIP Proxy, which can be the same as the SIP registrar for outgoing calls.

3) The intercom shall support dialing up to twelve separate numbers in sequence or as ring group.

e. Access control functionality

1) The intercoms' reader outputs shall be wired through the Weigand module to the existing access control system.

f. User Interface

1) Web server
a) The intercom shall contain a built-in web server making functionality and configuration available to multiple clients in a standard operating system and browser environment using HTTP, without the need for additional software.

2) IP addresses
a) The intercom shall be set with dynamically assigned IP addresses provided by a Dynamic Host Control Protocol (DHCP) server.
b) The intercom shall allow for automatic detection of the intercom based on WS Discovery when using a computer with an operating system supporting this feature.
c) The intercom shall provide support for IPv4.

g. Event functionality

1) The intercom shall be equipped with an integrated event functionality, which can be triggered by:
   a) Tamper / case open
   b) SIP Call state incl. incoming call
   c) Change of SIP registration status
   d) Video Motion Detection
   e) Noise Detection
   f) SIP DTMF sequences
   g) External input
   h) Access control events such as code, card, fingerprint entered
   i. Predefined time
2) Response to triggers shall include:
   a) Send notification, using HTTP or email
   b) Activate sound alarm
   c) Make or end call
   d) Send notification, using HTTP, HTTPS, Wiegand or email
   e) Send images, using FTP or email
   f) Activating external output
   g) Play audio clip

h. Protocol
1) The intercom shall incorporate support for at least HTTP, HTTPS, SIP 2.0, TFTP, RTSP, RTP, SMTP, DHCP opt 66, NTP, Syslog.
2) The SMTP implementation shall include support for SMTP authentication.
3) The camera shall incorporate support for at least IPv4, HTTP, HTTPS, SIP, SSL/TLS, QoS Layer 3 DiffServ, TCP, ICMP, SNMPv2c, RTSP, RTP, UDP, IGMP, RTCP, SMTP, FTP, DHCP, ARP, DNS, NTP,

i. Security
1) The intercom shall support the use of HTTPS and SSL/TLS, providing the ability to upload signed certificates to encrypt and secure authentication and communication of both administration data and video streams.
2) The intercom shall block its login page for 30 seconds after three faulty passwords have been submitted.
3) The intercom shall force user to change admin password upon first installation.
4) The intercom shall provide centralized certificate management, with the ability to upload CA certificates. The certificates shall be signed by an organization providing digital trust services.
5) The intercom shall support IEEE 802.1X authentication.
6) Selected services, such as RTSP or web config shall be configurable to only allow access from local devices.
7) The intercom shall restrict access to the built-in web server by username and password.
8) The intercom shall be equipped with tamper detection.

j. API support:
1) The intercom shall be fully supported by an open and published API (Application Programmers Interface), which shall provide necessary information for integration of functionality into third party applications.
2) The intercom shall conform to ONVIF profile S as defined by

the ONVIF Organization.
a) For ONVIF profile specifications, see www.onvif.org/

3) The intercom shall be interoperable/certified with major PBX and gateway manufacturers, including:
a) Cisco
b) Avaya
c) Broadsoft

k. Installation and maintenance
1) The intercom shall support secure configuration using HTTPS.
2) The intercom shall support the use of SNMP-based management tools according to SNMP v2c.
3) The intercom shall allow updates of the software (firmware) over the network, using TFTP, HTTP or web interface.
4) The intercom shall be time synchronized to the district NTP (Network Time Protocol) server.
5) The intercom shall support back-up and restore of configuration.
6) The intercom shall store all customer-specific settings in a non-volatile memory that shall not be lost during power cuts or soft reset.

l. Access log
1) The intercom shall be able to log events such as codes, phone calls, RFID cards etc., and provide them using HTTP interface for monitoring.
2) The administrator shall be able to set whether the particular messages are sent by the intercom immediately after any event occurs, or if the client registers for event logging and then asks for full report since last registration, all events at once.
3) The client shall be able to select which messages are reported from event log.

m. Intercom diagnostics
1) The intercom shall be equipped with LEDs, capable of providing visible status information. LEDs shall indicate the intercom's operational status and provide information about power, the network status and the intercom status.
2) The intercom shall be monitored by a Watchdog functionality, which shall automatically re-initiate processes or restart the unit if a malfunction is detected.

n. Hardware interfaces
1) Network interface
a) The intercom shall be equipped with one 10BASE-T/100BASE-TX Fast Ethernet-port, using a standard RJ45 connector and shall support auto negotiation of network speed (100 MBit/s and 10 MBit/s) and transfer mode (full and half duplex).
2) Doors
a) The intercom shall be equipped with programmable input supporting both short circuit activation or up to +30VDC for door monitor or Request to Exit (REX).
b) The intercom shall be equipped with two independent outputs for door control. One active providing at least 8VDC / 400mA and one NO/NC relay supporting up to 30V AC/DC 1A.
3) Audio

a) The intercom shall be equipped with line output.

4) Power
   a) The intercom shall be equipped with a removable terminal block providing connectivity for external power.
5) Multifunctional connector
   a) The camera shall, by using a “multi wire ribbon cable”, provide connectivity between main unit and modules.

o. Enclosure
1) The intercom shall:
   a) Be manufactured with IP54 rated housing, and be IK08 (IK07 when using Touchscreen module).
   b) Be fitted with a tamper switch.
   c) Be of modular design, supporting main unit and up to 29 additional modules.
   d) Be available in black and brushed nickel versions.

p. Power
1) Power over Ethernet IEEE 802.3af/802.3at Type 1 Class 0
2) 12 V DC
   a) Max: 2A

q. Environmental
1) The intercom shall:
   a) Operate in a temperature range of -40 °C to +60 °C (-40 °F to 140 °F)
   b) Operate in a humidity range of 10–95% RH (non-condensing).

2.4 NETWORK STROBE SIREN

A. Axis D4100-E Network Strobe Siren.
1. Connect Network Strobe Siren to associated 2N door station as indicated on drawings. Contractor to provide and install 1-18/4 conductor from 2N door station to strobe siren.
2. Program system so that green strobe and sounder is activated when door station is activated. Coordinate sound levels with owner.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The Contractor shall carefully follow instructions in documentation provided by the manufacturer to ensure all steps have been taken to provide a reliable, easy-to-operate complete system.

B. All equipment shall be configured in accordance with instructions provided by the manufacturer and systems administrator prior to district inspection.

C. All firmware found in products shall be the latest and most up-to-date provided by the manufacturer.

D. The contractor shall provide a 2N Indoor Touch 2.0 master station at the primary operator’s desk with its appropriate stand.

E. Contractor is responsible for working with other trades to ensure proper installation of all devices per recommended codes.

F. All equipment requiring users to log on using a password shall be configured with district specific password. No system/product default passwords shall be allowed.

END OF SECTION

SECTION 28 20 00

VIDEO SURVEILLANCE SYSTEM (VSS)

PART 1 - GENERAL

1.1 RELATED WORK

A. The following, in their entirety and as applicable, shall apply to this section. Including any associated drawings.
   1. Conditions of the Contract
   2. Division 1
   3. Division 26
   4. Division 27
   5. Division 28

1.2 DESCRIPTION OF WORK

A. Provide a complete and tested IP based digital video surveillance system (VSS) including cameras, cabling, digital image storage, integration and accessibility with Owner's Local/Wide Area Network (LAN/WAN), Internet accessibility thru remote view application software and simultaneous user access capability. Provide fully terminated unshielded twisted pair (UTP) cable, UTP terminations, racks, raceways, conduit, and other incidental and miscellaneous premises wiring system hardware as required for a complete and useable system. The installation shall comply with applicable codes and standards in effect at the job site and as indicated in the Specifications and Drawings.

B. The system shall be Non-Proprietary in nature and be available through multiple distribution channels in the nearest metropolitan marketplace. Systems that are manufactured and installed by a factory office and are not available through multiple distribution channels will not be accepted.

C. Provide all electronic hardware and coordinate with the building's LAN/WAN. The contractor shall coordinate with other system vendors, where appropriate, to facilitate equipment installation, scheduling, protection of equipment and access to the project site in order to provide the Owner a substantially complete project in a timely manner.

D. Acceptable manufacturers of NVR equipment shall be GCON Systems Enterprise Class NVR System or BCD Video Network Video Recorder only. Contractor must be a current Exacq Enterprise Certified integrator of the solution in the Houston marketplace and be able to include information on current support staff to be able to service this client. Seneca NVR part numbers and configuration are listed in the specification to define equipment capabilities and requirements for this project.

E. Contractor must be a current integrator of solution in the Houston marketplace and be able to include information on current support staff to be able to service this client as needed 24x7 for emergency support.

F. Contractor shall provide a complete turnkey solution to the owner and be responsible for the complete installation of a security camera system.

G. The contractor must be in good standing with the district and have no outstanding performance or warranty items at the time of bid. Any outstanding items or issues is grounds to disqualify the contractors bid.

1.3 QUALITY ASSURANCE

A. Installer Qualifications:
   1. The Video Surveillance System Installer shall be Exacq Enterprise certified and shall meet all applicable regulations. The Contractor shall be a firm normally employed in the security and surveillance industry.
   2. The contractor shall be certified by the manufacturing company in all aspects of design, installation and testing of the products described herein. Each contractor shall furnish with their submittal a letter from the manufacture indicating they are a dealer in good standing.
   3. The contractor must be certified by the manufacturer of the products, adhere to the engineering, installation and testing procedures and utilize the authorized manufacturer components and distribution channels.
   4. The contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size. The contractor shall own and maintain tools and equipment necessary for successful installation and testing of video surveillance distribution systems and have personnel who are adequately trained in the use of such tools and equipment.
   5. A resume of qualifications shall be submitted with the Contractor's proposal indicating the following:
      a. A list of five recently completed projects using the product proposed of similar type and size with contact names and telephone numbers for each.
      b. A list of test equipment proposed for use in verifying the installed integrity of metallic cable systems on this project.
      c. A technical resume of experience for the contractor's Project Manager and on-site installation supervisor who shall be assigned to this project.
      d. A list of technical product training attended by the contractor's personnel that shall install the video surveillance system shall be submitted.
      e. Any subcontractor who shall assist the video surveillance contractor in performance of this work shall have the same training and certification as the video surveillance contractor.

B. The Owner's representative reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.

1.4 REGULATORY REQUIREMENTS

A. Standards: All work shall be performed in accordance with the latest revisions of the following standards and codes:
   1. Local Building Code
   2. Local Electrical Code
   3. NEC National Electrical Code

B. Other references:
   1. TIA/EIA-568-A - Commercial Building Telecommunications Wiring Standard
   2. EIA/TIA-569 - Commercial Building Standard for Telecommunications Pathways and Spaces.
   3. TIA/EIA-606 - The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
   4. TIA/EIA-607 - Commercial Building Grounding and Bonding Requirements for Telecommunications
   5. TIA/EIA TSB 67 - Transmission Performance Specification for Field Testing of Unshielded Twisted-Pair Cabling Systems.

6. ISO/IEC 11801 - Generic Cabling Standard
7. EN 50173 - Generic Cabling Standards for Customer Premises

C. Governing Codes and Conflicts: If the requirements of these specifications or the Project Drawings exceed those of the governing codes, regulations, and manufacturer installation requirements, then the requirements of these specifications and the drawings shall govern. However, nothing in the drawings or specifications shall be construed to permit work not conforming to all governing codes, regulations, and manufacturer installation requirements.

1.5 SUBMITTALS

A. Project Initiation: Within fourteen (14) days of Notice to Proceed, the data network 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 material, hardware, and equipment to be used in the installation of the specified system. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner / Designer) and the manufacturer's supporting documentation demonstrating compatibility with other related products shall be included. The submittal shall have some type of distinguishing marker or pointer to indicated what specific product is to be provided
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 SCS installer complies with the entire specification section. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been approved by the Owner.
5. Each Submittal must have a detailed parts list. Quantities will not be required as the quantity of any portion of this system shall be as required for a complete and functional system and in conjunction with the contract documents.
6. Certifications: The contractor shall submit all certifications for approved products and the certifications must contain dates which are valid from the date of proposal and not expirer any sooner than 12 months after substantial completion of the project.
    a. Physical Security Professional (PSP) Certification: This certification must be held by an on-staff, full-time employee of the system installer. The holder must be staffed out of the office that is located within 75 miles of the projected.
    b. Manufacturer Authorized Dealer Certification must be held by the system installer's office that is located within 75 miles of the project and shall be a company certification, not and individual certification.
    c. Installer Certifications: Certification indicating that an individual has successfully completed installer training, issued by the VMS and Cameras Manufacturers specified herein, must be held by at least 25% of the, on-site, staff and be made available at the site if requested by the owner, architect, and/or project's technology consultant.

B. Shop Drawings: Submit the following items, for Owner review and approval, within twenty-eight (28) days of notice to proceed:
1. Proposed cable routing and grouping plan.
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 sleeved wall and floor pass-thru
b. Size of sleeve at each location installed
c. Quantity of cable passing through each sleeve
d. Location of devices and head end equipment.
e. Conduit routing, size, and quantity

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 Owner.
4. All subcontractors shall provide submittals to general contractor for normal distribution to Architects, Engineers and the Owner's project managers.

C. At Substantial Completion: Provide drawings, to the Owner, to reflect installed cabling with correct labeling and cable routing.

D. Close-out Procedures: Two (2) copies of the following documents shall be delivered to the building owner's representative at the time of system acceptance. Close out technology documents shall be separated from all other trade's documents. The close out finals shall include:

1. Inspection and Test Reports: During the course of the Project, the Contractor shall maintain an adequate inspection system to ensure that the materials supplied, and the work performed, conform to contract requirements. The Contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion.
2. Include the Name, address and telephone of the authorized factory representative with a 24-hour emergency service number.
3. The manual shall also include Manufacturer's data sheets and installation manuals/instructions for all equipment installed a list of recommended spare parts.
4. Generic or typical owner's instruction and operation manual shall not be acceptable to fulfill this requirement.
5. An up-to-date record ("as-built") set of approved shop drawing prints that have been revised to show each and every change made to the structure cabling system from the original approved shop drawings. Drawings shall consist of a scaled plan of each building showing the placement of each individual item of the technical cabling system equipment as well as raceway size and routing, junction boxes, and conductor size, quantity, and color in each raceway.
6. As-built Drawings shall include cable pathways, camera locations with correct labeling and MDF/IDF locations. A copy of the As-Built drawings reflecting the final locations of all cabling shall be given to the designated Owner's representative. The as-built drawings shall be prepared using AutoCAD 2012 or later. Provide the Owner with electronic versions of the as-builts on CD media.
7. All drawings must reflect final graphic numbering, point to point wiring, device address and programmed characteristics as verified in the presence of the engineer and/or the end user unless device addressing is electronically generated, and automatically graphically self-documented by the system.
8. A copy of the manufacturer's warranty on the installed system.
9. Any keys to cabinets and/or equipment and special maintenance tools required to repair, maintain, or service the system.
10. 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)

11. Upon completion of the work and at a time designated by the Architect or owner, provide formal training sessions for the Owner's operating personnel to include location, operation, and maintenance of all included systems and equipment. Minimum amount of training time shall be at least 4 hours.

1.6 QUALITY ASSURANCE

A. Contractor Qualifications:

1. The system installer shall be the authorized representative of the manufacturer to sell, install, and service the proposed manufacturer's equipment. The system installer shall have represented the security alarm manufacturer's product for a minimum of five (5) years' with experience installing and servicing systems of similar scope and complexity and evidence that is completed at least three (3) projects of similar design and is currently engaged in the installation and maintenance of systems herein described.
2. The system installer shall be licensed as required, by the State in which the project is located in, as a security services contractor to design, sell, install, and service security alarm systems.
3. The system installer shall provide 24-hour, 365 days per year emergency service with factory trained service technicians.
4. The installing firm shall have personnel on their staff that has been actively engaged in the business of designing, selling, installing, and servicing security systems for at least ten (10) years.
5. The proposing contractor for this system and the installing contractor of this system shall be of the same organization. Absolutely no subcontracting of any portion of this system by the proposing contractor will be allowed.
6. The proposing/installing contractor of this system must be an authorized dealer / integrator for the project's specified Access Control, Audio / Video Intercom, and the Intrusion Detection systems as well as the system specified in this section.
7. Contractor must be a current integrator of solution in the closest major metropolitan area marketplace, have a permanent office located within 75-miles of the project, and be able to include information on current support staff to be able to service this client.
8. All installation, configuration, setup, program and related work shall be performed by electronic technicians thoroughly trained by the manufacturer in the installation and service of the equipment provided.
9. The system installer shall submit credentials of completed manufacturer certification, verified by a third-party organization, as proof of the knowledge.
10. The Contractor shall provide four (4) current references from clients with systems of similar scope and complexity that became operational in the past three (3) years. At least three (3) of the references shall be utilizing the same system components, in a similar configuration as the proposed system
11. Contractor must be in good standing with the Owner and have no outstanding performance or warranty items at the time of bid. Any outstanding items or issues is grounds to disqualify the Contractor for performing any work on the project.

1.7 PRE-INSTALLATION MEETINGS

A. No less than a minimum of two weeks prior to rough-in or installation of any system devices, the Installer will be required to attend a pre-construction meeting with the Owner, Architect, and Security Consultant.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in manufacturer's unopened packaging bearing the brand

name and manufacturer's identification until ready for installation.

B. Handling: Handle materials to avoid damage.

1.9 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.10 SEQUENCING

A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.11 WARRANTY

A. The VSS furnished by the System Integrator including wiring, software, hardware and third-party products shall be fully warranted for parts, materials and labor for a minimum of 1 year from date of the final acceptance.

B. Manufacturer shall provide a limited 3-year warranty for the product to be free of defects in material and workmanship.

PART 2 -PRODUCTS

2.1 GENERAL

A. The data cabling to each camera location on this project shall be provided and installed by the data cabling contractor. The security camera installing contractor shall be responsible for the installation of all power wiring for exterior PTZ domes and power supplies.

B. The Contractor is responsible for providing all incidental and/or miscellaneous hardware not explicitly specified below as required for a complete and operational system.

C. Materials shall be as listed no alternate products will be allowed without prior consent of the projects security consultant. Any items approved as equivalent products shall be published by addendum ten days prior to proposal for Architect/Engineer review.

D. All equipment and materials used shall be standard components, regularly manufactured, regularly utilized in the manufacturer’s system.

E. All systems and components shall have been thoroughly tested and proven in actual use.

F. All systems and components shall be provided with the availability of a toll free 24-hour technical support phone number from the manufacturer. The phone number shall allow for immediate technical assistance for either the dealer/installer or the end user at no charge.

G. All systems and components shall be provided with an explicit manufacturer warranty.

2.2 DATA CLOSET (MDF/IDF) TERMINATION HARDWARE

A. Provide and Install new Tripplite, #B030-008-17-IP, NetDirector 8-Port 1U Rack-Mount

Console HDMI KVM Switch with 17 in. LCD and IP Remote Access, Dual Rail.

B. Security contractor is responsible to coordinate with district police technology department on acquiring network connections as well as any network configuration information such as IP numbers that will be required to connect NVR servers to district network.

C. Security contractor is responsible to provide network cabling connection, either fiber or category 6A, to owner provided network equipment. This connection allows NVR to be connected to owner's local area network.

D. Security contractor shall provide (1) Minuteman – E2000RTXL2U ups per NVR unit at each rack location to support NVR equipment. Provide 120v. electrical connection at location where NVR is installed.

2.3 CABLE AND INSTALLATION

A. The Contractor shall provide and install all low voltage plenum rated power cable to exterior PTZ dome camera locations from a central power supply(s). Each power cable shall be individually fused at the power supply so a short in one power cable will blow that fuse and not affect the other cameras. The power supply will be UL listed in an approved enclosure. It is the responsibly of the Contractor to size the power supply to handle the full load of the cameras.

B. The data cabling to each camera location on this project will be provided and installed by cabling contractor certified by Systimax and authorized to install the cable plant and connectivity products. All category 6A cable shall be Systimax Purple 2071 CAT6A.

C. Camera contractor is responsible to request and oversee all penetrations and all conduit runs as necessary for installation of CCTV installation.

D. All exterior penetrations require necessary weatherproofing to avoid moisture penetration.

E. All Cameras will require 10ft purple Cat6A patch chord at camera location and 7ft purple Cat6A patch chord at panel location provided by certified Systimax Data contractor.

F. All outdoor cable runs underground shall be in fiber rated for underground use according to Technology specs.

G. All power circuits required for the NVR servers are to originate as emergency power from its provided UPS.

H. Contractor shall not run any power cabling for any security equipment on rack tray system due to EMI considerations. Contractor shall provide individual cabling support for all low voltage power cabling.

I. All cabling for entire project shall be installed at 5'-0" intervals in dedicated support system using a j-hooks support system. Cable supports will be securely attached directly to building structure. Do not attach cabling or supports to ductwork, piping, grid hangers, conduit, or equipment.

J. Refer to CFISD structured cabling specifications for Category 6A materials and methods.

K. All category 6A cabling shall be routed to existing MDF and IDF locations and be terminated on existing racks. Provide additional patch panels as required and label ports

using existing labeling scheme.

L. For all cameras that will exceed the maximum category 6A cable limitation the contractor shall provide and install Veracity Outreach Max universal Ethernet and Poe Extender and clearly identify on as-builts. If installed a spare unit will be provided to the owner.

2.4 PROPOSALS

A. All proposals shall be in the format as shown in the General Conditions Section of the Specification.

2.5 DIGITAL VIDEO RECORDING, MANAGEMENT AND TRANSMISSION SYSTEM

A. The contractor shall provide and install Network Video Recorders for this project.

B. Final connection for all new IP cameras shall be provided by the camera contractor. Coordinate all recording settings and functions with owner prior to programming.

C. Network Video Recorders shall be preprogrammed to include a floor plan graphic of each school and the exact camera locations and name of cameras. Field verification of camera names is required to complete this task.

2.6 EQUIPMENT REQUIRED

A. Provide a 5-year warranty for all NVR equipment.

B. Digital Video Recorders:
1. Provide one GCON Systems Enterprise Class NVR System or BCD Video Network Video Recorder, per 50 cameras to be installed unless stated otherwise by the owner.
2. The contractor shall coordinate correct Exacq software version prior to submitting or procuring equipment.
3. NVR must have SSA agreement in place for two years at time of install.
4. In response to proposal, contractor shall provide owner with amounts for annual service maintenance agreement that can be purchased after warranty period has expired.

2.7 CAMERAS

A. Camera Types:
1. All ceiling mounted cameras shall be surface mounted on the ceiling using ceiling mounting kit and accessible by 10ft ladder.
2. All cameras shown on the drawings to be corner mounted shall receive corner mount kit by specified camera manufacturer, no exception.
3. Interior Fixed cameras shall be Bosch Flexidome 5000i or AXIS P3265LV if primary is not available. – TYPE C
4. Exterior Fixed cameras shall be Bosch Flexidome 5000i or Axis P3265-LVE if primary is not available. – TYPE B
5. Interior Fish Eye cameras shall be Bosch Flexidome 5100I 6mp. – TYPE E
6. Multi sensor Interior/Exterior Camera shall be Axis P3727-PLE or Wisenet PNM-C16083RVQ– TYPE A
7. Duo Cameras shall be AXIS P4707-PLVE Platform with IR or Wisenet PNM-7082RVD if Axis is unavailable. – TYPE D
8. Axis F9114 and Axis F4105-LRE sensors shall be provided to view around a column or skylight where a center mounted single camera cannot be employed. All F4105-LRE lens must be installed with Axis TU6005 plenum cable accessory.

– TYPE F

9. Specialty PTZ camera will be Axis Q6318-LE PTZ if specifically called for by owner-TYPE G

B. Field of View Determination by the contractor as necessary for fixed camera locations shall be performed at no additional cost to provide the view desired by the owner. Contractor shall coordinate all final camera views and locations with owner for final approval.

C. IP camera address scheme will be provided to contractor by the owner. All Camera addresses shall follow the provided scheme and be sequential.

D. Refer to Drawings for additional camera part numbers, Quantities.

E. Confirmation of camera type per location requires customer verification.

2.8 ADDITIONAL HARDWARE OR EQUIPMENT REQUIRED

A. Licensing to be provided for all necessary equipment.

B. Camera mounts and brackets shall be per camera manufacturer.

C. One ViewSonic VX3211-2K-MHD 32” LED Monitor is required per NVR.

D. One of each type of camera used on the project is required upon final inspection for spare replacement equipment.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Fire Wall Penetrations: The Contractor shall avoid penetration of fire rated walls and floors wherever possible. Contractor shall also seal all floor, ceiling and wall penetrations in fire or smoke barriers and in the wiring closet.

B. Provide three sided pre-finished metal hood and seal to wall where conduit penetrates exterior wall.

C. Install new conduit on portable pipe supports- (low profile type), as manufactured by Portable Pipe Hangers or Advanced Support Products. Provide roof protection pads under each support. Coordinate location and routing with design engineer prior to rough-in or installation of system.

D. Do not install wall mounted cameras into metal fascia. Ensure they are mounted into brick, and sealed top sides (Not bottom)

E. Wall Penetrations:

1. Exterior Penetrations- shall be performed by a certified electrical contractor and be sleeved with metallic conduit and resealed with an Underwriter Laboratories (UL) approved sealant.
2. Interior Penetrations- shall be sleeved with metallic conduit and resealed with an Underwriter Laboratories (UL) approved sealant.

F. Cable Pathway:

1. In suspended ceiling and raised floor areas where duct, cable trays or conduit are not available, the Contractor shall bundle, in bundles of 25 cables or less,

with cable ties snug, but not deforming the cable geometry. Cable bundles shall be supported via “J” hooks attached to the existing building structure and framework at a maximum of five (5) foot intervals. Plenum rated cable ties shall be used in all appropriate areas. The Contractor shall adhere to the manufacturer’s requirements for bending radius and pulling tension of all cables.

2. Cables shall not be attached to lift out ceiling grid supports or laid directly on the ceiling grid.
3. Cables shall not be attached to or supported by fire sprinkler heads or delivery systems or any environmental sensor located in the ceiling air space.

3.2 EQUIPMENT RACK CONFIGURATION

A. Cable Placement: Cable installation in the wiring closet must conform to the Project Drawings. All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance location. Avoid crossing areas horizontally just above or below any riser conduit. Lay and dress cables to allow other cables to enter the conduit/riser without difficulty at a later time by maintaining a working distance from these openings.

B. All incoming cables shall be routed on the cable tray and neatly dressed down to the patch panels

C. Cable shall be routed as closely as possible to the ceiling, floor or corners to ensure that adequate wall or backboard space is available for current and future equipment. All cable runs within the wiring closet shall be horizontal or vertical within the constraints of minimum cable bending radii. Minimum bend radius shall be observed. Cables shall not be tie-wrapped to electrical conduit or other equipment.

3.3 WIRING INSTALLATION

A. General:
   1. Cabling between wiring closet and camera locations shall be made as individual home runs. No intermediate splices may be installed or utilized between the wiring closet and the camera location.
   2. All cable must be handled with care during installation so as not to change performance specifications.

B. Exposed Cable: All cabling shall be installed inside walls or ceiling spaces whenever possible. Exposed cable shall only be run where indicated on the Drawings. Additional exposed cable runs shall require Owner approval, and shall only be allowed when no other options exist. Cabling shall be installed concealed at all times, except in unfinished mechanical rooms or wiring closets where cable shall be installed exposed and located to avoid conflicts with pass-through cabling, etc. Tie wraps shall be used to provide a neat appearance. Provide “D” rings or the appropriate cable guides to dress the cable.

C. Placement: All cabling and associated hardware shall be placed so as to make efficient use of available space. All cabling and associated hardware shall be placed so as not to impair the Owner’s efficient use of their full capacity.

D. Cable Routes: All cabling placed in ceiling areas must be in conduit, cable tray, or J-Hooks. Cable supports shall be permanently anchored to building structure or substrates. Provide attachment hardware and anchors designed for the structure to which attached and that are suitably sized to carry the weight of the cables to be supported. Attaching cable to pipes or other mechanical items is not permitted. Use J-Hooks for up to 15 cables (Caddy CAT 21 or CAT 32 hooks with appropriate brackets). All runs of sixteen (16) or more cables, provide cable rings on 36” maximum centers to hang cable. Cable shall be routed so as to provide a minimum of 18” spacing from light fixtures, sources of

heat, power feeder conduits and EMI sources. Cabling shall not be attached to ceiling grid support wires. Cable runs shall be parallel or perpendicular to building structure. Multiple cables to be banded together every 6 feet.

3.4 DOCUMENTATION

A. Labels: The Contractor shall label all outlets using permanent machine engraved labels approved by the Owner. Label patch panels in the wiring closet to match those on corresponding camera locations. The font shall be at least one-eighth inch (1/8") in height, block. All labels shall correspond to as-builts and to final test reports.

B. Contractor shall ensure complete typed labeling of all cameras with numbers that correspond to locations on video server. Labeling system shall correspond to the Owner's labeling system. Verify with Owner. Provide tags (black letters on white labels, plastic coated) on all cables and outlets.

C. All cables shall be labeled at both ends with a machine label and all terminations shall be stenciled with a typed label for quick circuit identification. Labeling shall conform to TIA/EIA standard 606 and include interconnect cable identification numbers.

D. A floor plan, clearly labeled with all numbered camera locations, shall be included in the as-built plans.

3.5 CABLE TESTING - BY MANUFACTURER'S REQUIREMENTS

A. Notification: The Owner/Architect/Engineer shall be notified one week prior to any testing so that the testing may be witnessed.

B. Final Acceptance: Before requesting a final acceptance, the Contractor shall perform a series of end-to-end installation performance tests. The Contractor shall submit for approval a proposal describing the test procedures, test result forms and time table for all copper and fiber optic cabling.

C. Procedures: Trained personnel shall perform all testing. Acceptance of the test procedures discussed below is predicated on the Contractor's use of the recommended products and adherence to the inspection requirements and practices set forth. Acceptance of the completed installation shall be evaluated in the context of each of these factors.

D. Errors: When errors are found, the source of each error shall be determined, corrected and the cable retested. All defective components shall be replaced and retested. Retest results must be entered on the test results form. All corrections shall be made prior to final acceptance test.

3.6 INSPECTION

A. Conformance to the installation practices covered above are to be verified when completed. In some cases, the Owner / Architect / Engineer may observe before acceptance.

3.7 WARRANTY

A. Labor and all other costs as necessary to maintain the equipment in operating condition as intended by the product manufacturer after a period of 1 year shall be negotiated with the owner upon project completion.

B. Guarantee and warrant all equipment provided for a period of 3 years following date of

substantial completion, or a period equal to the stated guaranty/warranty offered by the product manufacturer, whichever is the longest in duration. All such warranties shall include all parts (NVR's, and Cameras).

END OF SECTION

SECTION 28 31 00

INTRUSION DETECTION SYSTEM (IDS)

PART 1 - GENERAL

1.1 RELATED WORK

A. The following sections shall associate with this specification as applicable.
   1. General Conditions
   2. Supplementary Conditions
   3. Division 1
   4. Division 26 in its entirety.
   5. Division 27 in its entirety.
   6. Division 28 in its entirety.

1.2 WORK INCLUDED

A. The Contractor shall furnish and install a complete 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 of 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
   6. Power Supplies
   7. Accessories required to provide a complete IDS
   8. System O and I Manuals
   9. System Programming
   10. Batteries
   11. Wiring

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 connect this location to the Owner's monitoring station as designated by the owner.

G. 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.

H. 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.

I. The documents issued for this project are conceptual in nature, including but not limited to specifications and drawings. It shall be the responsibility of the approved installer to furnish a complete and functional system, including the items shown on the drawings, in the specifications, and items not designated in either. The installer's shop drawings and product data submittals shall represent a complete system, and documents accepted do not relieve the installer from being required to provide any materials, equipment, or labor to furnish a complete and functional system as recognized by the Project's Technology Consultant and the Owner.

J. Contractor shall integrate all Emergency Eyewash systems into the IDS. Provide cabling connecting both systems. Coordinate with Emergency Eyewash systems contractor.

K. 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 same, connected to existing transfer switch at the existing Commons building, servicing the existing High School buildings. Provide all required cabling and devices for fully functional systems.

L. Project scope is an expansion of the existing system.

1.3 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.

1.4 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.

1.5 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

2.1 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

2.2 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 of3
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.

2.2 FIELD DEVICES

A. Ceiling mounted 360 Degree, infrared sensors / microwave motion sensors. Model DS 9370
   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. Where exposed contacts are used they shall be heavy duty switches protected by die cast aluminum housing and the leads shall be encased in steel armor jacket. The leads must pass through the back box by the correct size twin screw cable clamp connector.
   2. Magnetic Door / Hatch contacts shall be model Sentrol 2505A-L contact
   3. Overhead Roll up contacts shall be model Ademco 958 contact
   4. 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.

2.3 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. All 120v Power shall be furnished by the contractor.

D. All Security system conduits as show on the drawings shall be furnished by the contractor as part of their scope of work.

E. Coordination with the electrical contractor is the responsibility of the Security Contractor to ensure all conduit is in place for a complete installation.

F. All systems shall be connected to an emergency power source as available.

G. Color code of all security intrusion detection system and access control wiring shall be purple in color.

H. 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

3.1 INSTALLATION

A. All wiring shall be in accordance with the National Electrical Code, Local Codes, and article 760 of NFPA Standard 70. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings

B. All wire shall be UL Listed CL2 for limited energy (300V) applications and shall be installed in conduit. Limited energy MPP wire maybe run open in return air ceiling plenums provided such wire is UL Listed for such applications and is of the low smoke producing fluorocarbon type and complies with NEC Article760 if so approved by the local authority having jurisdiction.

C. No AC wiring or any other wiring shall be run in the same conduit as security alarm wiring.

D. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit “fill” not to exceed 40% per NEC.

E. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.

F. Systems utilizing open wiring techniques with low smoke plenum cable

shall provide conduit in all inaccessible locations such as inside walls, all mechanical / electrical rooms, or other areas where wiring might be exposed or subject to Damage.

G. All vertical wiring and all main trunk / riser wiring shall be installed in a complete raceway / conduit system. All riser boxes shall be adequately sized for the number of conductors transversing the respective box as well as the number of terminations required.

H. Provide a Green 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 shall have a dedicated POPIT module interface per device on the project and be wired Normally closed for monitoring purposes.

V. 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.

3.2 CABLE PATHWAYS

A. Cable Support:
   1. All wire not installed inside conduit or a designated cable tray system shall be installed in a dedicated cable support system for the entire run of each cable. Including, but not limited to service loops.
      a. Approved Cable Support 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.

3.3 SYSTEM OPERATION

A. When an alarm condition is detected by any of the alarm initiating devices, the following

functions shall occur:

1. The system keypad's interior audible device shall sound until silenced by using proper security code or after system time out.
2. A custom system alarm message shall be displayed on the LCD display. This display will show the alarm device location in plain English. Location and partition custom messages shall be field programmable.
3. The remote signaling tie connection shall be activated at the Owner's approved central security monitoring location and/or other Owner designated location.
4. Printer shall provide printed copy of events recorded in logger. Install adjacent to security panel.

3.4 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:

3.5 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.

3.6 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.

3.7 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

SECTION 28 46 00

FIRE DETECTION AND ALARM SYSTEM

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Provide all detailed engineering, documentation, materials and devices, installation, calibration, software programming and check-out necessary for a complete and fully operational fire detection and alarm system in accordance with the full intent and meaning of the drawings and specifications including, but not limited to, the following:
   1. Supply, install and connect all hardware necessary to provide a complete and operational fire detection and alarm system.
   2. Supply, install and wire all field hardware, fire alarm control panel, power supplies, power circuits, alarm initiating devices, audible and visual alarm devices, auxiliary control relays, signal initiating and signaling devices, conduits, wires, fittings and all accessories required for the system to perform as specified as required.
   3. Supply, install, debug and test all software required to provide all software functions described in accordance with the full intent and meaning of the drawings and specifications.
   4. Coordinate the work specified under this Section with other trades and contractors to assure a complete and fully operational system.

B. The intent of fire detection and alarm system work is specified in this section and indicated on the drawings. The installing contractor shall design and provide a complete system, meeting the requirement of this specification. The Contractor shall provide all fire alarm and initiation devices required for a complete system acceptable to all governing authorities. Provide proper spacing and coverage of all devices.

C. Expand existing system fire alarm and voice evacuation system as required by the AHJ. in its entirety to current district standards and code requirements. Verify Point-ID reporting to monitoring station and/or provide necessary equipment and programming to provide Point-ID reporting.

1.2 RELATED SECTIONS

A. Division 22 and Division 23

B. Sprinkler Systems

C. Elevators

D. Food Service

1.3 CODES / STANDARDS / REFERENCES (LATEST EDITIONS)

A. National Fire Protection Association (NFPA):
   1. NFPA1 Fire Code
   2. NFPA 13 Systems, Installation
   3. NFPA 17 Dry Chemical Extinguishing Systems
   4. NFPA 70 National Electrical Code
   5. NFPA 72 National Fire Alarm and Signaling Code.
   6. NFPA 80 Fire Doors and Fire Windows
   7. NFPA 90A Standard for the Installation of Air Conditioning and

Ventilating Systems.

8. NFPA 92A Smoke Control Systems
9. NFPA 101 Life Safety code.
10. NFPA 105 Smoke Control Door Assemblies
11. NFPA 1221 Standard for the Installation, Maintenance and Use of Emergency Services Communications Systems.
12. NFPA 2001 Fire Extinguishing Systems, Clean Agent

B. UL: Underwriters Laboratories, Inc.
1. 217 Single and Multiple Station Smoke Detectors.
2. 268 Smoke Detectors for Fire Protective Signaling Services.
3. 864 Control Units for Fire Protective Signaling Services, 9th Edition.
4 864 Transient protection
5. 1480 Speakers for Fire Protective Signaling Systems
6. UL Fire Protection Equipment Directory.
7. UL Electrical Construction Materials Directory.

C. Uniform Federal Accessibility Standards (UFAS).

D. Factory Mutual P7825 Approval Guide

E. American National Standards Institute (ANSI).

F. National Electrical Manufacturer's Association (NEMA).

G. Institute of Electrical and Electronic Engineers (IEEE).

H. Electronic Industries Association (EIA-232-C): Interface between Data Terminal Equipment and Data Communication Equipment Employing Serial Binary Data Interchange.

I. Requirements of American Disabilities Act (Public Law 101-336).

J. Local Accessibility Standards

K. State Fire Marshall or Requirements of Local Authorities having Jurisdiction

L. State Insurance Code

M. International Building and Fire Code Adopted by Local Authority Having Jurisdiction

N. Local & State Building Codes

O. In addition the above requirements, comply with all local codes. Where discrepancies exist between codes, drawings or specifications, the more stringent requirement shall prevail. Installation shall be subject to approval, inspection and test of applicable regulatory agencies.

1.4 MANUFACTURER'S, PLANNER'S AND INSTALLER'S QUALIFICATIONS

A. The manufacturer shall regularly and presently produce, as the manufacturer's principle products, the equipment and material of the type and design specified for this project, and shall have manufactured the item for at least 5 years.

B. Manufacturer's product shall have been in satisfactory operation on three installations of similar size, type and design as this project, for approximately 3 years.

C. Manufacturer shall submit at the time of bid a list of installations where the products have been in operation.

D. The installing contractor shall have been actively engaged in the business of designing, selling, installing, and servicing fire alarm systems for at least ten (10) years.

E. The entire Fire Detection and Alarm System shall be installed by an authorized representative of the Fire Alarm Manufacturer and certified by the manufacturer to distribute, sell, and install the specified fire alarm and smoke detection system. Include all components, elements, and testing and acceptance procedures.

F. If the submitted system is being supplied by an authorized distributor of the equipment manufacturer, the distributor shall have been actively engaged in the sale, installation and service of the type of system proposed for this project for a minimum of 10 years.

G. Any proposed installer who cannot show evidence of such qualifications may be rejected. The services of a technician provided and certified by the equipment manufacturer shall be provided to supervise the installation and tests of the system.

H. Furnish evidence there is an experienced and effective service organization, which carries a stock of repair parts for the system to be furnished.

I. The installing contractor shall be licensed by the State Fire Marshall to design, sell, install, and service fire alarm systems as required by the State Insurance Code.

J. The installing contractor shall have on his staff a minimum of two (2) Fire Alarm Planning Superintendent (APS) licensed by the State Fire Marshall's office for such purpose and under whose supervision installation, final connections, and check out will take place as required by the State Insurance Code.

K. The APS shall be a certified NICET Level III state licensed fire alarm planner under whose supervision system design shall take place. In lieu of a NICET certified state licensed fire alarm planner, the contractor or supplier may provide design supervision by a registered professional engineer, who regularly engages in the design of fire alarm systems as required by the Texas Board of Professional Engineers.

L. The installing contractor shall provide 24-hour, 365 days per year emergency service with factory trained, state licensed service technicians.

M. Material shall be new and in perfect condition when installed.

N. Electrical or electronic equipment provided under this Division which has been damaged, exposed to weather, or is, in the opinion of the Architect/Engineer otherwise unsuitable because of improper fabrication, storage, or installation, shall be removed and replaced with new equipment, at no additional cost to the owner.

O. Quality Control Assurance:
   1. All components of the fire alarm system shall be products of an Underwriters Laboratories, Inc. listed fire alarm manufacturer, and shall bear the UL Label. Partial listing shall not be acceptable.
   2. All components of the fire alarm systems shall use the most current technology available.
   3. Only new parts shall be installed at the time of initial installation and to repair the system during the warranty period. No reconditioned parts shall be used.

4. All devices shall be tested and certified that they meet or exceed the “Service Life Expectancy Rating” as outlined by UL and NFPA.

1.5 COORDINATION

A. It shall be the responsibility of the installing contractor to coordinate all requirements surrounding installation of the fire alarm system with all other trades.

B. Contractor shall schedule a pre-construction meeting with Owner/Architect regarding the Fire Detection and Alarm System.

1.6 DEFINITIONS

A. General: Wherever mentioned in this specification or on the drawings, the equipment, devices and functions shall be defined as follows:
   1. Alarm Signal: A signal, which signifies a state of emergency requiring immediate action and immediate notification of the Fire Department. These are signals such as:
      a. The operation of a manual station.
      b. The operation of a fire suppression system switch.
   2. Pre-Alarm Signal: A signal, which indicates a detection device, has operated. These signals require and immediate response, but do not require immediate notification of the Fire Department.
   3. Supervisory Signal: A signal, which signifies the impairment of fire protection system, which may prevent its normal operation.
   4. Trouble Signal: A signal, which indicates that a fault, such as an open circuit or ground, has occurred in the system.
   5. Alarm Zone: An alarm initiating device or combination of devices connected to a single alarm initiating device circuit.
   6. Pre-Alarm Zone: A detector or group of detectors connected to a single detector circuit, which can send an alarm to the central control panel.
   7. Supervision Zone: A supervisory signal initiating device or combination of such devices connected to a single supervisory signal circuit.
   8. Communication Zone: A fire alarm indicating device or series of devices arranged to visually and/or audibly indicate a fire alarm signal.

1.7 SUBMITTALS

A. Contractor shall meet with Owner’s Fire Alarm System representative prior to submission of formal/final shop drawings to Architect to allow the Owner and Architect to review a preliminary draft copy of the submittal to verify compliance with the specifications and any detailed requirements of the project. After the draft submittal has been reviewed by the Architect / Owner / Engineer, and formal shop drawings have been reviewed by Architect and returned to the Contractor, the required pre-construction meeting shall take place with Owner / Architect / Engineer.

B. Before the final set of shop drawings are submitted to Architect / Engineer, submit drawings to the jurisdictions for approval. All approvals shall be noted on the drawings or by letter from the authorities having jurisdiction (AHJ).

C. All preliminary and as-built design drawings and supporting documentation shall include: Floor Plan Drawings, riser diagrams, control unit wiring diagrams, point to point wiring diagrams, and typical wiring diagrams as described herein.
   1. Name of Owner and Occupant
   2. Date
   3. Location, including street address.

4. Provide a complete written, item-by-item, line-by-line, specification review stating compliance or deviation in full description.
5. Device Legend
6. Input/output programming matrix
7. Licensed Designer Information – Registered Professional Engineer or Alarm Planning Superintendent (APS)
8. Battery calculations
9. Notification appliance circuit voltage drop calculations
10. Floor Plan
    a. Floor identification
    b. Point of compass
    c. Correct graphic scale
    d. All walls and doors
    e. All partitions extending to within 15 percent of ceiling height
    f. Room descriptions
    g. Fire alarm device / component locations
        1) Signal notification devices
        2) Initiation devices
        3) Smoke control systems
        4) Initiation of automatic extinguishing equipment
        5) Doors that unlock or close automatically
        6) Zone verification for detection devices
        7) Fire/Smoke damper control
        8) Fire alarm panel location
        9) Fire alarm annunciators
        10) Control valves to Fire Protection System
        11) Duct smoke detectors
        12) Supervisory devices
        13) Elevator location
        14) Elevator recall system location
    h. Location of fire alarm primary power connections
    i. Location of monitor/control interfaces to other systems
    j. Riser locations
    k. Methods for compliance with NFPA 72 24.3.13 for survivability (emergency voice systems) as required in NFPA 72 12.4 where applicable.
    l. Ceiling height and ceiling construction details
    m. Fire alarm system riser diagram
        1) General arrangement of the system, in building cross-section
        2) Number of risers
        3) Type and number of circuits in each riser
        4) Type and number of fire alarm components/devices on each circuit, on each floor or level
11. Control unit wiring diagrams shall be provided for all control equipment, power supplies, battery chargers, and annunciators and shall include the following:
    a. Identification of control equipment depicted
    b. Location(s)
    c. All field wiring terminals and terminal identification
    d. All indicators and manual controls, including the full text of all labels
    e. All field connections to supervising station signaling equipment, releasing equipment, and fire safety control.
    f. Typical Wiring Diagram shall be provided for all initiating devices, notification appliances, remote light emitting diodes (LEDs), remote test stations, and end-of-line and power supervisory devices.
12. Complete system bill of material of all hardware components.
13. Detailed system operational description. Any specification differences and

deviations shall be clearly noted and marked.

14. Submittal sheets sequentially numbered with the format: sheet number of number total. For example: 1 of 3.
15. Complete set of manufacturer's operating instructions, circuit diagrams and the information necessary for proper installation, operation and maintenance.
16. Manufacturers catalog cut sheets shall be provide for each piece of equipment with the appropriate model or part number highlighted in cases where multiple model numbers or part numbers are shown.
17. Fire detection and alarm system's panel configuration complete with peripheral devices, batteries, power supplies, and interconnection diagrams.
18. Submit sound and visual level to confirm that number and location of signaling devices will provide required sound and visual levels throughout the building.
19. Sample of proposed graphic/text annunciation.

1.8 OPERATION AND MAINTENANCE MANUALS

A. Submit complete sets of operation and maintenance manuals. Manual, less as-builts, and sign-off sheets, shall be provided upon completion of the work. Approval of the manual will be required prior to substantial completion.

B. The Operation and Maintenance Manual shall consist of the following:

1. The manual shall include the names, addresses and telephone numbers of each Contractor installing products, and of the nearest service representative for each product. The manual shall have a Table of Contents and tab sheets. Update manuals to include modifications made during installation, checkout and acceptance. The manual shall include the sections described in the following paragraphs.
2. The Functional Design Section shall identify the operational requirements for the system and explain the theory of operation, design philosophy, and specific functions. Hardware and software functions, interfaces, and requirements shall be provided for system operating modes.
3. The Hardware Section shall describe equipment provided, including general description and specifications, installation and checkout procedure, electrical schematics and layout drawings. Alignment and calibration procedures, manufacturer's repair parts list indicating source of supply, interface definition, signal identification and wiring diagrams. Also, include a complete parts list of all components as well as a list of recommended spare parts. The spare parts list shall include, for each item, the manufacturer's name, the model of the part, and serial number, if appropriate, and a physical and electrical description of the part.
4. The Software Section shall describe programming and testing, starting with a system overview and proceeding to a detailed description of each software module, to instruct the user on programming or reprogramming any portion of the system and other information necessary to enable proper system usage.
5. The Operation Section shall provide instructions for operation of the system, including system start-up procedures, use of system and applications software, alarm presentation (where applicable), failure and recovery procedures, preventive maintenance schedule, parameter schedules and sequence definition, and system access requirements.
6. The Maintenance Section shall provide descriptions of maintenance for equipment including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.
7. The Shop Drawings section shall include copies of all approved shop drawings and submittal materials updated to "AS BUILT".

1.9 AS-BUILT DRAWINGS

A. Prepare and submit detailed “As-Built” drawings. The drawings shall include certified test of the system, testing and acceptance sign-off sheets, and other items specified elsewhere to be performed after initial submission of operation and maintenance manuals, complete wiring diagrams showing connections between all devices and equipment, both factory and field wired. Include a riser diagram and drawings showing the as built location of all devices and equipment. The drawings shall show the system as installed, including all deviations from both the project drawings and the approved shop drawings. The drawings shall be prepared on uniform sized sheets, the same size as the project drawings. The plan drawings shall be 11x17 inch and inserted in the specified Operations and Maintenance Manuals. Provide electronic copies in PDF and Autocad.dwg format.

1.10 OPERATIONAL INSTRUCTIONS

A. Provide a typeset printed or a laser jet printed instruction card mounted behind a lexan plastic or glass cover in a stainless steel or aluminum frame. Install the frame in a conspicuous location observable from the Fire Alarm Control Panel (FACP). The card shall show those steps to be taken by an operator when a signal is received as well as the functional operation of the system under all conditions, normal, alarm, and trouble. The instructions shall be approved by the Architect/Engineer before being posted.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers acceptable contingent upon Products’ compliance with the specifications:
   1. Notifier INSPIRE series or its successor
   2. Siemens-Cerberus PRO Modular

B. Additional Instructions
   1. All equipment, materials, accessories, devices, etc. covered by this standard and/or noted on the contract drawings shall be new and unused and be U.L. listed for their intended use.
   2. All equipment provided shall be available for purchase from at least two authorized distributors within the greater Houston metropolitan area. Single source proprietary equipment is prohibited unless approved by CFISD.

2.2 SYSTEM DESCRIPTION

A. System shall be a completely multiplexed addressable fire detection and alarm system, tested and left in first class operating condition. Voice evacuation systems where required or specified, shall have voice alarm notification wherever audible notification is required.

B. The system shall provide communication with initiating and control devices individually. All of these devices shall be individually annunciated at the fire alarm control panel. Annunciation shall include the following conditions for each point:
   1. Alarm
   2. Trouble.
   3. Open
   4. Short
   5. Device missing/failed.

C. System circuits shall be wired as follows: Notification Appliance Circuit (NAC) shall be Style B supervised and signal line circuit (SLCs) shall be Style 4 as describe in NFPA 72.

D. The system shall contain independently supervised initiating device circuits. The alarm activation of any initiation circuit shall not prevent the subsequent alarm operation of any other initiation circuit. All addressable loops shall have loop isolation protection devices to maintain partial fire alarm system integrity should a fault occur. A loop isolation device shall not exceed a maximum of 20 devices.

E. There shall be supervisory service initiation device circuits for connection of all sprinkler water flow switches and valves. Device activation shall cause a general alarm at the fire alarm control panel. Each flow and tamper switch shall have an individual address.

F. There shall be independently supervised and independently fused indicating appliance circuits for all alarm signaling devices. Disarrangement conditions of any circuit shall not affect the operation of other circuits.

G. Auxiliary manual controls shall be supervised so that an “off normal” position of any switch shall cause an “off normal” system trouble.

H. The incoming power to the system shall be supervised so that any power failure must be audibly and visually indicated at the fire alarm control panel. A green “power on” LED shall be displayed continuously while incoming power is present at the building fire alarm control panel.

I. The system batteries shall be supervised so that a low battery condition or disconnection of the battery shall be audibly and visually indicated at the building fire alarm control panel.

J. The system modules shall be electrically supervised for module placement. Should a module become disconnected, the system trouble indicator shall illuminate and the audible trouble signal shall sound.

K. The system shall have provisions for disabling and enabling all circuits individually for maintenance or testing purposes.

L. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal 120 VAC power in a normal or supervisory mode for a period of 24 hours with 20 minutes of alarm operation at the end of this period as a minimum. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operations shall be automatic. If batteries are fully discharged, the charger shall recharge them back to full charge in four hours.

M. All external circuits requiring system operating power shall be 24 VDC and shall be individually fused at the respective fire alarm control panel.

N. All addressable devices shall have the capability of being disabled or enabled individually from the fire alarm control panel.

O. A maximum of 75 percent capacity of addressable devices shall be multi-dropped from a single pair of wires. Systems that require factory reprogramming to add or delete devices within the capability of the designed system are unacceptable. Expansion of the designed system shall be accomplished by factory reprogramming.

P. The communication format to the addressable devices shall be a completely digital poll/response protocol to allow t-tapping of the circuit wiring. A high degree of communication reliability must be obtained by using parity data bit error checking routines for address codes and check sum routines for the data transmission portion of the protocol.

Q. Each addressable device must be uniquely identified by an address code. The system must verify that proper type device is in place and matches the desired software configuration. All remote or external panels shall have an individual address for monitoring.

R. Wiring type, distances, survivability, and wiring configuration types shall be approved by the equipment manufacturer. The system shall allow a line distance of up to 2,500 feet to the furthest addressable device on a Style B circuit. Plenum rated fire alarm cable shall have an outer jacket insulation color of red.

Minimum wire size shall be:

Initiating Circuits: 18 AWG
Strobe Circuits: 14 AWG
Relay Control Circuits: 18 AWG
Voice/Speaker Circuits: 16 AWG

S. Each panel extender shall have an individual address.

2.3 FIRE ALARM CONTROL PANEL (FACP)

A. The FACP shall be capable of communicating with the types of addressable devices specified below. It shall display only those primary controls and displays essential to operation during a fire alarm condition. Keyboards or keypads shall not be required to operate the system during fire alarm conditions. Panel shall support a minimum of 500 addressable points.

B. The fire alarm control panel (FACP) shall be fully enclosed in a lockable steel enclosure as specified herein. All operations required for testing or for normal care and maintenance of the system shall be performed from the front of the enclosure. If more than a single unit is required to form a complete control panel, the unit enclosures shall match exactly. The system shall operate at 24 VDC.

C. Panel shall be large enough to accommodate all components and also to allow ample gutter space for interconnection of all panels as well as all field wiring. Each enclosure and each component shall be identified by an engraved red laminated phenolic resin nameplate. Lettering on the nameplate shall not be less than 1" high. Individual components and modules within the cabinets shall be identified by engraved laminated phenolic resin nameplates.

D. A local audible device shall sound during alarm, trouble, or supervisory conditions. This audible device shall sound differently during each condition to distinguish one condition from another without having to view the panel. This audible device shall also sound during each key press to provide an audible feedback to ensure that the key has been pressed properly.

E. The following primary controls shall be visible through a front access panel:
1. Minimum 3-lines, minimum 40 alphanumeric characters per line display.
2. Individual red system alarm LED.
3. Individual yellow supervisory service LED.
4. Individual yellow trouble LED.
5. Green “power on” LED.

6. Alarm acknowledge key.
7. Trouble acknowledge key.
8. Alarm silence key.
9. System reset key.

F. Under normal condition, the front panel shall display a “SYSTEM IS NORMAL” message and the current time and date.

G. Should an abnormal condition be detected, the appropriate LED (Alarm, Supervisory or Trouble) shall flash. The panel audible signal shall pulse for alarm conditions and sound steady for trouble and supervisory conditions.

H. System Display:
1. The system shall support the following display mode options:
2. The display shall include a minimum 80-character backlit alphanumeric Liquid Crystal Display (LCD) or comprehensive LCD wide format display or graphic user interface (GUI).
3. The display shall annunciate status information and custom alphanumeric labels for all intelligent detectors, addressable modules, internal panel circuits, and software zones.
4. The display shall also provide Light-Emitting Diodes.
   a. The display shall provide minimum 8 Light-Emitting-Diodes (LEDs) that indicate the status of the following system parameters:
      AC POWER
      FIRE ALARM
      PRE-ALARM WARNING
      SECURITY ALARM
      SUPERVISORY SIGNAL
      SYSTEM TROUBLE
      DISABLED POINTS
      ALARM SILENCED
5. The display shall also provide keypad functions.
   a. The display keypad shall be an easy to use QWERTY type keypad, similar to a lap-top PC keyboard. This shall be part of the standard system and have the capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels shall be provided to prevent unauthorized system control or programming.

I. Alarm conditions shall be displayed on the alphanumeric display. The top line of 40 characters shall be the point label and the second line shall be the device type identifier. The system alarm LED shall flash on the control panel until the alarm has been acknowledged. Once acknowledged, this same LED shall latch on. A subsequent alarm received from another zone shall flash the system alarm LED on the control panel. The alphanumeric display shall show the new alarm information.

J. Each independently supervised circuit shall include a discrete readout to indicate disarrangement conditions per circuit.

K. Acknowledgment for each abnormal condition shall be provided. Acknowledge keys shall not be pass code protected. Acknowledge keys shall be protected by the locked enclosure only. After all points have been acknowledged, the LEDs shall glow steady and the audible device be silenced. The total number of alarms, supervisory and trouble conditions shall be displayed, along with a prompt to review each list chronologically. The end of the list shall be indicated by the message, “END of LIST”.

L. Pressing the appropriate acknowledge button shall display the first unacknowledged condition in the appropriate list (either alarm, supervisory or trouble), and shall require another acknowledge button for each subsequent alarm condition. Press to acknowledge shall only silence the displayed point.

M. Alarm silencing:
1. Should the “Alarm Silence” button be pressed, all audible alarm signals shall cease operation.
2. Visual signals shall not be extinguished during alarm silence inhibit mode.

N. System reset:
1. The “System Reset” button shall be used to return the system to its normal state after an alarm condition has been remedied. The alphanumeric display or reset LED shall step the user through the reset process with simple English Language messages.
2. Should an alarm condition continue to exist, the system shall remain in an abnormal state. System control relays shall not reset. The audible device and the alarm LED shall be on.
3. Should the alarm silence inhibit function be active, the System Reset and alarm silence key shall be ignored.

O. Additional function keys, or their equivalent, shall be provided to access status data and control the function for the following points:
1. HVAC - Bypass
2. Indicating appliance circuits bypass
3. Auxiliary relays points bypass
4. All other input/output points.

P. The following status data or their equivalent shall be available:
1. Primary state of point.
2. Device, PID and card type information.
3. Current priority of outputs.
4. Disable/enable status.
5. Verification tallies of initiating devices.
6. Automatic/manual control status of output points.
7. Acknowledge status.
8. Relay status.

Q. LED supervision: Where provided, all slave module LEDs shall be supervised for burnout or disarrangement. Should a problem occur the alphanumeric display shall display the module and LED location numbers to facilitate location of that LED.

R. System trouble reminder: should a trouble condition be present within the system and the audible trouble signal silenced, the trouble signal shall resound at pre-programmed time intervals to act as a reminder that the fire alarm system is not 100% operational. Both the time interval and the trouble reminder signal shall be programmable.

S. The fire alarm control panel features shall include, but not be limited to:
1. Setting of time and date.
2. LED testing.
3. Alarm, trouble, and abnormal condition listing.
4. Enabling and disabling of each monitor point separately.
5. Activation and deactivation of each control point separately.
6. Changing operator access levels.
7. Walk test enable.

8. Running diagnostic function.
9. Displaying software revision level.
10. Displaying historical logs.
11. Displaying card status.
12. Point listing.
13. For maintenance purposes, the following lists, or their equivalent, shall be available from the system program and/or the point lists menu:
    a. All points list by address.
    b. Monitor point list.
    c. Signal list.
    d. Auxiliary control list.
    e. Feedback point list.
    f. LED/switch status list.
14. Fire Drill:
    a. Fire drill activation switch shall activate all audio/visual devices only. Fire drill shall not enter into the alarm sequence of operation, shall not close smoke or fire/smoke dampers, shall not deactivate any HVAC systems, kitchen hoods, etc.
    b. Activation of any trouble or alarm condition shall supercede the evacuation drill.
    c. Fire drill shall be canceled by the system reset key, alarm silence, or drill key.
15. Scrolling through menu options or lists shall be accomplished in a self-directing manner. These controls shall be located behind an access door.
16. The alphanumeric display shall have an alpha numeric, back-lighted LCD, LED, or gas plasma display. The display shall support numeric and both upper and lower case letters. Lower case letters shall be used for soft key titles and prompting the user. Upper case letters shall be used for system status information. A cursor shall be visible when entering information.
17. The system shall be capable of being tested by one person. The actuation of the “enable walk test” program at the fire alarm control panel shall activate the “Walk Test” mode of the system, which shall cause the following to occur:
    a. The remote monitoring circuit connection shall be bypassed.
    b. Control relay functions shall be bypassed.
    c. The control panels shall show a trouble condition.
    d. The panel shall be capable of selecting either: the alarm activation of any initiation device causing the audible signals to activate for two seconds or the alarm activation of any initiation devices causing the audible signals to code a number of pulses to match the zone number.
    e. The panel shall automatically reset itself after signaling is complete.
    f. Any momentary opening of an initiating or indicating appliance circuit wiring shall cause the audible signals to sound for 4 seconds indicating a trouble condition.
    g. The control panel shall be capable of supporting up to 8 separate testing groups whereby one group of points may be in a testing mode and the other (non-testing) groups may be active and operate as programmed per normal system operation. After testing is considered complete, testing data may be retrieved from the system in chronological order to ensure device/circuit activation.
    h. Should the walk test feature be on for an inappropriate amount of time, it shall revert to the normal mode automatically.
18. Provide three (3) access levels with level 3 being the highest level. Level 1 action shall not require a pass code. Pass codes shall consist of up to ten (10) digits. Changes to pass codes shall only be made by Level 3 authorized personnel.

a. When entering a pass code, the digits entered shall not be displayed. All key presses shall be acknowledged by a local audible sound and/or visual "*" in the 80 character display.
b. When a correct pass code is entered, the new access level shall be in effect until the operator manually logs out or the keypad has been inactive for ten (10) minutes.
c. Should an invalid code be input, access shall be denied.
d. Access to a level shall only allow the operator to perform all actions within that level plus all actions of lower levels, not higher levels.
e. The following keys/switches, or their equivalent shall have access levels associated with them:
Set time/date.
Manual control
Disable/enable
Clear historical alarm log
Clear historical trouble log
Walk test
Change alarm verification
f. The following keys/switches shall not be pass code protected and shall be protected by the lockable enclosure:
Alarm Silence
System Reset
Acknowledge

19. The fire alarm system shall allow for loading and editing special instructions and operating sequences as required. The system shall be capable of being reprogrammed to accommodate system expansion and facilities changes in operation. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control panel. Loss of primary and secondary power shall not erase the instructions stored in memory.
20. Resident software shall allow for full configuration of initiating circuits so that additional hardware shall not be necessary to accommodate changes in, for instance, sensing of normally open contact devices to sensing of normally closed contact devices, or from sensing of normally open contact devices to sensing a combination of current limited and non-current limited devices on the same circuit and being able to differentiate between the two, or changing from a non-verification circuit to a verification circuit or vice-versa.
21. Resident software shall also allow for configuration of indicating appliance and control circuits so that additional hardware shall not be necessary to accommodate change in, for instance changing a non-coded indicating appliance circuit to a coded circuit.
22. The main fire alarm panel shall have the resident ability to store a minimum of 600 system events in chronological order of occurrence. Event history shall include all system alarms, troubles, operator actions, unverified alarms, circuit/point alterations, and component failures. Events shall be time and date stamped. Events shall be stored in non-volatile buffer memory. Access to history buffer shall be secured via 5-digit password security code. The system shall have the capability of recalling alarms and trouble conditions in chronological order for the purpose of recreating an event history. Loss of primary or secondary power shall not erase the events stored in the memory. Each recorded event shall include the time and date of that event's occurrence.
a. The following Historical Alarm log events shall be stored:
Alarms
Alarm acknowledgment
Alarm silence
System reset

Alarm historical log cleared

b. The following historical trouble log events shall be stored:
Trouble conditions
Supervisory alarms
Trouble acknowledgment
Supervisory acknowledgment
Alarm verification tallies
Walk tests results
Trouble historical log cleared

23. Alarm verification shall be by device, whereby only verification from the same device will confirm the first activation and cause the alarm sequence to occur.
24. The control panel shall have the capability to display the number of times (tally) a device has gone into a verification mode. Should this verification tally reach a pre-programmed number, a trouble condition shall occur.
25. The control panel shall have a dedicated supervisory service LED and a dedicated supervisory service acknowledge key. Pressing the supervisory service acknowledge key shall silence the supervisory audible signal while maintaining the supervisory service LED “ON” indicating the off-normal condition.
26. Activation of an auxiliary bypass key shall override the selected automatic functions.
27. The system shall have keys that will allow the operator to display all alarms, troubles, and supervisory service conditions including the time of each occurrence.
28. RS-232-C output: the fire alarm control panel shall be capable of operating remote generic consumer type printers; output shall be ASCII from an EIA RS-232-C connection with an adjustable baud rate. Each RS-232-C port shall be capable of supporting and supervising a remote display and printer. Data amplifiers shall be used to increase data line distance when required.
29. Panel shall be sized to accommodate all required equipment. Panel shall be equipped with locks and transparent door, providing freedom from tampering yet allowing full view of the various displays and controls.

T. The fire alarm control panel shall have a 25% spare initiating point and battery capacity for future use.

U. The power supply shall provide all control panel and peripheral power needs with filtered power as well as unregulated 24VDC power for external audio-visual devices. The audio-visual power shall be increased as needed by adding additional modular expansion power supplies. All power supplies shall be designed to meet UL and NFPA requirements for POWER-LIMITED operation on all external signaling lines, including initiating circuits and indicating circuits. Design the system power supplies and power trunk wiring for all annunciation devices required, and to add a minimum of five (5) 110cd visual devices in the future. Individual design loading shall not exceed 70% of power supply and system wiring capacity.
1. Input power shall be 120VAC 60Hz. The power supply shall provide internal supervised batteries and automatic charger. The power supply shall provide positive and negative ground fault supervision, battery/charger fail condition, AC power fail indicators. The power supply shall also provide supervision of modular expansion power supplies as may be required.
2. Surge protection shall be integral to the control panels.
3. Each power supply shall be monitored and have an individual address.

V. Network (IP) Interface Card:
1 IP Communicator module for fire alarm panel
2. Programmed for remote monitoring of system

3. Supervise IP Ethernet connection every 90-seconds or less
4. Coordinate with owner for address for campus data network
5. Program for Point ID, providing point address/description reporting

W. Cellular Communicator:
1. UL 864 listed
2. Panel powered
3. Upload/Download capable
4. Transmit all signals and information from the DTMF communicator
5. Program for Point ID, providing point address/description reporting

X. Detector sensitivity shall be programmable from the control panel from the following sensitivities: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0 and 3.7% obstruction. Detectors shall be able to be programmed to alert a trouble signal at a lower obstruction and shall report an alarm if the smoke density increases to a predetermined set point. Control Panel and Detectors shall be capable of “Day-Night” automatic sensitivity adjustments.

Y. Control Switches:
1. Acknowledge/step Switch
2. Signal Silence Switch
3. System Reset Switch
4. System Test Switch
5. Lamp Test

Z. Automatic Detector Test: The system shall include a special automatic detector test feature, which permits reading and adjustment of the sensitivity of all intelligent detectors from the main control panel. An automatic detector test shall occur automatically fourteen times each twenty-four hour period or be initiated manually from the FACP as desired. In addition, the automatic test feature shall also permit the functional testing of any "intelligent" detector or addressable interface device individually from the main control panel. Automatic detector test sequencing shall be terminated upon receipt of an alarm condition. Detector test shall report all unprogrammed devices installed and report all programmed devices not installed.

AA. Emergency voice alarm communication system:
1. The emergency voice and tone communication system shall be a pre-built system and shall only require two wires from a polarity reversal circuit or a dry contact for activation. It shall supervise the NO dry contact (if used) and provide a form C trouble relay activation in the event of a system fault. The Voice Communication System shall incorporate minimum 50 watts true RMS amplifiers for both tone and speech amplification. The system shall have a load capacity of up to 100 watts. Optionally, the Voice Communication System shall be capable of providing 50 watts of audio with full backup. The Voice Communication System shall be capable of operating as a stand-alone system or follow the activation of the fire alarm/suppression system. The Voice Communication System shall include a regulated power supply and shall be capable of charging and housing its own batteries. There shall be no need to calculate the load requirements or draw any energy from the fire alarm/suppression system. The Voice Communication System shall come with one speaker supervisory zone as a standard and shall be capable of supervising any combination of up to 11 speaker and/or strobe monitoring modules.
2. A full set of control switches including an all call, tone interrupt, trouble silence and reset shall be available at the Voice Communications System. The Voice Communications System control panel shall also have a green POWER ON LED, a red ALARM LED, a yellow BROWN OUT LED and a yellow SYSTEM

TROUBLE LED.

3. The Voice Communication System shall be able to detect a short on any speaker or strobe zone during the normal and alarm mode. The shorted zone shall be isolated from the system and a dedicated LED on the supervised zone shall indicate the short circuit condition. The system shall produce an audible and visual signal indicating that a trouble condition has occurred. Similarly an open circuit shall create a trouble condition and corresponding LED annunciation at the affected zone and at the main control module. Zones that are not shorted or opened shall remain operational.
4. The Voice Communications System shall be able to detect a brownout condition on the AC supply. In the brownout condition the Voice Communication System shall activate a dedicated LED and an audible trouble signal. Ground faults shall activate the system trouble LED and the audible trouble signal, as well as specific LEDs indicating negative and positive ground faults.
5. The Voice Communication System shall be field configurable for 25 or 70.7 volt RMS audio output via program jumpers.
6. The Voice Communication System shall have a digital message player / recorder. The digital message player / recorder shall be capable of storing alert and evacuation tones as well as an emergency voice message. It shall be possible to modify the digital message and tones in the field using a built-in acoustic microphone or headphone jack connected to an audio device. There shall be no need for the burning of eproms in order to program the digital message player / recorder. The digital message player / recorder shall be supervised by the Voice Communication System. The Voice Communications System shall provide a backup evacuation tone in the event of a digital message player / recorder failure.
7. An alarm condition shall cause an audible signal and a red LED to activate. A Voice Communication System with a digital message player / recorder shall produce an ALERT tone followed by an emergency voice message, and in turn followed by an ALARM tone. The number of tone repetitions shall be configurable by the setting of DIP switches on the digital message player / recorder.
8. The sheet metal enclosure shall include a hinged deadfront allowing easy access to all the Voice Communication System components for the purposes of wiring, setting the system configuration and servicing. A door with a key lock shall be part of the Voice Communication System enclosure.

2.4 FIELD DEVICES

A. All devices shall be supervised for trouble conditions. The fire alarm control panel shall be capable of displaying the type of trouble condition (open, short, device missing/failed). Should a device fail, it shall not hinder the operation of other system devices.

B. Visual Signals:
   1. Strobe lights shall be of the electronic flashing xenon strobe type and operate on 24 VDC. The strobe light shall be capable of producing 75 candela on axis to comply with ADA and UL 1638 requirements, and 15, 30, or 110 candela to comply with UL 1971 requirements. Visual signals in common areas of illumination shall have synchronized flash. Provide white with red letters.
   2. If required to be mounted in student toilets / restrooms, gymnasiums, student locker / dressing rooms shall have a protective cover.

C. Combination Alarm Signal and High Intensity Visual Signals:
   1. Strobe lights shall be of the electronic flashing xenon strobe type and operate

on 24 VDC. The strobe light shall be capable of producing 75 candela on axis to comply with ADA requirements, and 15, 30 or 110 candela to comply with UL 1971 requirements. Visual signals in common areas of illumination shall have synchronized flash. Each unit shall provide a Code 3 Temporal tone. The horn shall be capable of an output of 95dB at 10', and intensity adjusted accordingly for the area of coverage. Electronic Mini-Sounder or horn set on low setting shall be provided in interior rooms 900 square feet or less. Mini-sounder shall not be used in any corridors, mechanical electrical rooms and similar large spaces and areas of high ambient noise level. Provide white with red letters.

2. All combination audio / visual devices mounted in student toilets / restrooms, gymnasiums, and student locker / dressing rooms shall have a protective cover.
3. The audible emergency alarms shall produce a sound that exceeds the prevailing sound level in the room or space by at least 15 dba or shall exceed any maximum sound level with a duration of 60 seconds by 5 dba, whichever is louder with or without protective cover. Sound levels for alarm signals shall not exceed 110 dba at the minimum hearing distance from the audible appliance.

D. Exterior Audible / Visual Signal:
1. Provide semi-flush mounted, molded of high impact red thermoplastic and listed for exterior weatherproof locations.

E. Combination Voice Signal and High Intensity Visual Signals:
1. Strobe lights shall be of the electronic flashing xenon strobe type and operate on 24 VDC. The strobe light shall be capable of producing 75 candela on axis to comply with ADA requirements, and 15, 30 or 110 candela to comply with UL 1971 requirements. Visual signals in common areas of illumination shall have synchronized flash.
2. If required to be wall mounted in student toilets, gymnasiums, corridors, student locker / dressing rooms, provide wire guard protective cover.
3. The visual signal lens housing shall be white with red lettered FIRE or as approved by Architect. The speaker and visual signal shall be mounted to a common white speaker baffle. The visual signal shall flash at a rate of minimum of 1 Hz and maximum of 3 Hz, and shall use a xenon strobe type lamp or other high intensity long life light source. The lamp intensity shall be a minimum of 75 candela.
4. The speaker shall be UL 1480 compatible with the control equipment. Unit shall operate within a temperature range of 150°F to -30°F. High output speakers, UL minimum 87dB at 10 feet with speaker taps of .33.66/1.25/2.5 watts. Standard output speakers, UL 75-81 dB at 10 feet with speaker taps of .5/1/1.75/2.75 watts. Capacitor for line supervision.

F. Ceiling mounted recessed mounted speakers shall be UL 1480 compatible with the control equipment. Unit shall operate within a temperature range of 150°F to -30°F. UL minimum 78-87 dB at 10 feet with speaker taps of .25, .5/1.0/2.0 watts. Round, white baffle in gypboard or plaster ceilings, provide 2x2 lay-in grid with UL enclosure, tile bridge supports when recessed in lay-in ceiling tiles Capacitor for line supervision.

G. Surface mounted speakers shall be UL 1480 compatible with the control equipment. Unit shall operate within a temperature range of 150°F to -30°F UL minimum 100 dB at 15 watts at 10 feet. Speaker taps via 7-position selector switch, 25-vol., .48/.94/1.8/7.5/15 watts. Fully enclosed wiring terminals. Capacitor for line supervision. Raco #911 Series Life Safety Appliance back box and adapter, or appliance manufacturer back box.

H. Addressable Manual Pull Stations:
   1. The manual station shall provide address-setting means using rotary decimal switches. No binary coding shall be required.
   2. Manual stations shall be designed for semi-flush mounting on standard electrical box. The station shall be constructed of hi-impact red molded Lexan with instructions for station operation in raised white letters. Stations shall be of the dual action type.
   3. Install Stopper STI1100 series covers with horns on all manual pull stations, except at the FACP and Remote Annunciator.
   4. Do not specify or use ionization only type detectors unless reviewed and approved by CFISD. Multi-criteria detectors that include ionization detection as one of the criteria to initiate and alarm are acceptable.
   5.

I. Intelligent Photoelectric Smoke Detectors:
   1. The detectors shall use the photoelectric principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the ANALOG level of smoke density. The detector shall provide automatic sensitivity "drift" compensation. The detector shall also provide a "maintenance alert" feature whereby the detector shall initiate a trouble condition should the unit's sensitivity approach the outside limits of the normal sensitivity window.
   2. The detectors shall provide address-setting means electronically and automatically at the control panel and programmed for alarm verification.
   3. The detectors shall provide operational status and alarm state LED. Under normal conditions, the LED shall flash, indicating the detector is operational and in regular communication with the control panel. An output connection shall also be provided in the base for connecting an external remote alarm LED.
   4. The detector shall be semi-flush ceiling mounted and be provided with modular detector head with twist-lock base. No radioactive material shall be used.
   5. Voltage and RF transient suppression techniques shall be employed as well as smoke signal verification circuit and an insect screen.

J. Duct photoelectric smoke detectors:
   1. Detectors shall be analog addressable type.
   2. To minimize nuisance alarms, detectors shall have an insect screen and be designed to ignore invisible airborne particles or smoke densities that are below the factory set alarm point. No radioactive material shall be used.
   3. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control panel.
   4. Voltage and RF transient suppression techniques shall be employed as well as smoke signal verification circuit and an insect screen.
   5. Remote alarm/power LED indicator with test switch shall be provided. Unit shall be wall or ceiling mounted in readily visible and accessible area near the location of detector; exact location of unit to be approved by the Architect/Engineer.
   6. Detectors shall operate on the same principles and exhibit the same basic characteristics as area type photoelectric smoke sensors. The detector shall operate in air velocities of 300 FPM to 4,000 FPM. Each detector shall interface directly to the system SLC loop without the requirement of interface zone modules.
   7. The unit shall consist of a clear molded plastic enclosure (or remote mounted LED status indicator shall be provided next to the smoke detector) with

integral conduit knockouts to provide visual viewing of detector/sensor for monitoring sensor operation and chamber condition. The duct housing shall be provided with gasket seals to insure proper seating of the housing to the associated ductwork. Each unit's sampling tubes shall extend the width of the duct and be provided with porosity filters to reduce sensor/chamber contamination.

8. The detectors shall provide alarm and power status indication by LED. Under normal conditions, the LED shall flash, indicating the detector is operational and in regular communication with the control panel. Steady illumination of the LED shall indicate that the control panel has detected and verified an alarm condition. An output connection shall also be provided in the base for connecting an external remote alarm LED.
9. The detectors shall provide address setting means electronically and automatically from the control panel and programmed for alarm verification.

K. Intelligent Thermal Detectors:
1. The detectors shall use dual electronic thermostats to measure temperature levels in its chamber and shall, on command from the control panel, send data to the panel representing the analog temperature level.
2. The detectors shall provide address-setting means electronically and automatically at the control panel.
3. The detectors shall provide operational status and alarm state LED. Under normal conditions, the LED shall flash, indicating the detector is operational and in regular communication with the control panel. An output connection shall also be provided in the base for connecting an external remote alarm LED.
4. The detector shall be semi-flush ceiling mounted and be provided with modular detector head with twist-lock base.
5. Thermal Detectors shall be combination rate-of-rise and fixed-temperature-rated at 135°F for areas where ambient temperatures do not exceed 100°F and shall be 200°F for areas where ambient temperatures exceed 100°F but not 150°F. The fixed temperature element shall consist of a fusible alloy retainer and actuator shaft. Detectors shall have a smooth ceiling rating of 2,500 square feet. Detectors shall be located as specified and where required by local code authority.
6. Provide fixed temperature 190°F detector in kitchen and kiln room in lieu of combination rate-of-rise / fixed-temperature type.

L. Addressable Carbon Monoxide Detection:
1. System sensor #CO1224 with addressable identification of the CO Detector’s alarm and trouble contact status. UL listed to Standard 2075 Standard for Gas and Vapor Detectors and Sensors.
2. Unit to be powered by the fire alarm system non-resettable 24 VDC supervised power supply.
3. Electro-chemical CO detection.
4. Integral 85db local alarm with local hush/test switch for silence or test.
5. Alarm contacts and trouble contacts for detector trouble, loss of power, and end of life.

M. Auxiliary AHU Relays: Air Products model MR-101C relays shall be provided for HVAC and AHU control and interface. Relays shall be heavy-duty type with contacts rated up to 10 amps at 120V AC, 60 HZ. Relays shall be provided with NEMA I dust cover assembly and be provided with DPDT contacts as well as activated LED indicator.

N. Voltage sensing relays: Addressable control modules for voltage sensing relay interface shall be FCM-1.

O. Monitor Module:
1. Addressable monitor modules shall be provided where required to interface to contact alarm devices.
2. The monitor module shall provide address-setting means electronically and automatically at the control panel. A status/alarm LED shall be provided which shall indicate that the monitor module is operational and in regular communication with the control panel, and indicate detection of an alarm condition.

P. Control Module
1. Control/relay modules shall be provided where required to provide audible alarm interface and/or relay control interface. The control module may be optionally wired as dry contact (form C) relay.
2. The control module shall provide address-setting means electronically and automatically at the control panel. A status/alarm LED shall be provided which shall indicate that the control module is operational and in regular communication with the control panel and indicate when the device is actuated via the fire alarm control panel.

Q. Auxiliary Interface Points: All auxiliary input points (fire suppression hoods, water flow, fire pump, AHU shut-down points, tamper switches, fire extinguishing systems etc.) shall be connected as required, and addressed as a separate initiating point of annunciation at the fire alarm panel and any remote annunciator as required.

R. Water flow switches / Valve supervisory switches shall be provided and installed by the fire protection contractor and connected by the fire alarm contractor. Wiring of these field devices to the fire alarm system shall be the responsibility of the fire alarm contractor. It is the responsibility of this contractor to ensure the proper function of the system. Each fire protection zone (flow switch) and (Valve switch) shall be addressed electronically and automatically at the control panel as a separate point of annunciation at the fire alarm panel. Coordinate exact location with fire protection contractor and civil drawings.

2.5 VESDA – VERY EARLY WARNING ASPIRATING SMOKE DETECTION SYSTEM

A. Approved Manufacturers:
1. System Sensor (FASAST) – Detection devices for Cooler / Freezer areas 200 square feet or larger, atriums / high ceiling areas with difficult access.
2. Xtralis (VESDA) – Detection devices for Cooler / Freezer areas 200 square feet or larger, atriums / high ceiling areas with difficult access.

B. A Very Early Warning Smoke Detection System similar to the VESDA VLI System shall be installed throughout the cooler and freezer storage areas 200 square feet and larger, and as an alternative to beam type detectors at high ceiling areas with difficult access.. The system shall consist of highly sensitive LASER-based Smoke Detectors with aspirators connected to networks of sampling pipes, intelligent filtration arrangement with fail-safe operation, sub-sampling probe (inertial separator), built-in clean air zero capability, local USB configuration port and Ethernet networking port. VESDA detection system shall be networked with the specified Notifier Fire Alarm Control Panel.

C. Design Requirements
1. The system shall consist of an air sampling pipe network to transport air to the detection system, supported by calculations from a computer-based design

modeling tool.

2. It shall be tested and approved to cover up to 2,000m^2 (20,000 sq.ft).
3. It shall have a built-in simple user interface indicating alarm and fault status and include a reset / disable button.
4. It shall provide absolute smoke detection.
5. It shall be approved to provide very early warning smoke detection and provide four alarm levels corresponding to Alert, Action, Fire 1 and Fire 2. These levels shall be programmable and able to be set at sensitivities ranging from 0.05-20% obs/m (0.016–6.4% obs/ft.).
6. The detector shall be specifically designed for industrial applications.
7. It shall consist of a highly sensitive LASER-based smoke detector with in-field clean air zero capability, aspirator, intelligent filter and secondary filter.
8. It shall be modular, with field replaceable detection chamber, aspirator, intelligent filter and secondary filter.
9. It shall have four pipe inlets for sample air.
10. It shall incorporate per pipe ultrasonic flow monitoring and provide staged airflow faults.
11. It shall have a built-in and field replaceable intelligent filter placed after the flow monitoring circuitry.
12. Intelligent filter shall:
    a. Dilute the sampled air for prolonged detector life.
    b. Combine sample air from all pipe inlets.
    c. Divide sampled air into filtered clean air and unfiltered air before mixing them together.
    d. Use HEPA filter with more than 99% efficiency for filtered clean air i.e. removing more than 99% of contaminant particles of 0.1microns or larger, to provide clean air for dilution.
    e. Use a mesh/screen for the unfiltered air for protection against lint type of particles.
    f. Be fail-safe and supervised for correct operation with built-in capability to alert for when replacement is required.
    g. Maintain consistent detector sensitivity over time.
    h. Have ultrasonic airflow monitoring of the unfiltered sampled air through the intelligent filter.
13. It shall have a field replaceable aspirator after the intelligent filter where the diluted sampled air flows through the aspirator prolonging its life.
14. The aspirator shall be a purpose-designed rotary vane air pump. It shall be capable of allowing for multiple sampling pipe runs up to 360m (1,200ft) in total, (4 pipe runs per detector) with a transport time per applicable local codes.
15. It shall have a sub-sampling probe (inertial separator) after the aspirator for reduced dust intake in to the detection chamber.
16. It shall have a secondary foam filter after the sub-sampling probe (inertial separator) where the sub-sampled air flows through the foam filter prolonging detection chamber life. The foam filter shall be capable of filtering particles in excess of 20 microns from the sampled air.
17. It shall have a field replaceable smoke detection chamber which stores the calibration values with the chamber assembly.
18. It shall have capability for in-field clean air zero to provide absolute smoke detection.
19. It shall have capability to measure blockages in the air path in to or out of the detection chamber.
20. It shall have an enclosure rating of IP54.
21. The detector shall allow for direct wall mounting or using a supplied mounting plate.
22. It may be inverted as required in specific applications.

23. It shall be self-monitoring for filter contamination.
24. It shall be configured via local USB port with Ethernet port for remote monitoring.
25. It shall have Fire and Fault relay outputs in addition to three configurable relays. The relays shall be software programmable to the required functions and must be rated at 2 AMP at 30 VDC.
26. It shall have at least one general purpose input (GPI).
27. It shall have Power In and Power Out connections to allow powering more than one detector from one power supply.
28. Optional equipment may include a dedicated Xtralis VSM graphics package.
29. It shall report any fault on the unit by using configurable fault relay outputs or via PC based configuration and monitoring system.
30. The detector shall have built-in event and smoke logging. It shall store smoke levels, alarm conditions, operator actions and faults. The date and time of each event shall be recorded. Each detector (zone) shall be capable of storing up to 18,000 events.

D. Programming Requirements

Using either USB or Ethernet port the detector shall allow programming of:

1. IP address and related fields to support Ethernet based networking
2. Four smoke threshold alarm levels
3. Time delays
4. Configurable relay outputs for remote indication of detector conditions
5. Holidays and day/night changeover times
6. Major and minor airflow fault limits
7. Aspirator speed
8. General purpose input function
9. Alarm and fault latching

E. Sampling Pipe

1. The sampling pipe shall be smooth bore. Normally, pipe with an outside diameter (OD) of 25mm or 1.05” and internal diameter (ID) of 21mm or ¾” should be used.
2. The pipe material should be suitable for the environment in which it is installed. VESDA pipe material shall be UL 1887 Plenum rated CPVC).
3. All joints in the sampling pipe must be air tight and made by using solvent cement, except at entry to the detector.
4. The pipe shall be identified as Air Sampling/Aspirating Smoke Detector Pipe along its entire length at regular intervals not exceeding the manufacturer’s recommendation or that of local codes and standards.
5. All pipes shall be supported at not less than 1.5m (5ft) centres, or that of the local codes or standards.
6. The far end of each trunk or branch pipe shall be fitted with an end-cap and made air-tight by using solvent cement. Use of an end-cap will be dependent on ASPIRE2 calculations.

F. Sampling Holes

1. Sampling holes shall not be separated by more than allowed for conventional point detectors as required by 30 feet as local codes and standards. Intervals may vary according to calculations. For NFPA the maximum allowable distance is 30ft.
2. Each sampling point port shall be identified in accordance with Codes or Standards.
3. Provide per manufacturer’s recommendations and standards in relation to the number of sampling points and the distance of the sampling points from the

ceiling or roof structure and forced ventilation systems.

4. Sample port size shall be as specified by ASPIRE2 calculations.

G. Detection Alarm Levels:

The laser-based ASD system shall have four (4) independently programmable alarm thresholds. The four alarm levels may be used as follows:

Alarm Level 1 (Alert)

Activate a visual and audible alarm in the fire risk area.

Alarm Level 2 (Action)

Activate the electrical/electronic equipment shutdown relay and activate visual and audible alarms in the Security Office or other appropriate location.

Alarm Level 3 (Fire 1)

Activate an alarm condition in the Fire Alarm Control Panel to call the Fire Monitoring Service and activate all warning systems.

Alarm Level 4 (Fire 2)

Activate a suppression system and/or other suitable countermeasures.

The alarm level functions as listed are possible scenarios. Program as directed by Owner to the best utilization of these facilities for each application and the requirements of local A.H.J.

H. Initial Detection Alarm Settings

1. Alarm Level 1 (Alert) 0.2% obs/m (0.064% obs/ft.)
2. Alarm Level 2 (Action) 0.3% obs/m (0.096% obs/ft.)
3. Alarm Level 3 (Fire 1) 0.40% obs/m (0.128% obs/ft.)
4. Alarm Level 4 (Fire 2) 2.0% obs/m (0.64% obs/ft.)

I. Initial (factory default) Alarm Delay Thresholds

Initial (factory default) settings for the alarm delay threshold shall be:

1. Alarm Level 1 (Alert) 10 seconds
2. Alarm Level 2 (Action) 10 seconds
3. Alarm Level 3 (Fire 1) 10 seconds
4. Alarm Level 4 (Fire 2) 10 seconds

J. Fault Alarms: The Detector Fault relay shall be connected to the appropriate alarm zone on the Fire Alarm Control Panel (FACP) in such a way that a Detector Fault would register a fault condition on the FACP. The Minor Fault and Isolate relays shall also be connected to the appropriate control system. Provide as required by local Codes, Standards or Regulations.

K. Power Supply and Batteries: The system shall be powered from a regulated supply of nominally 24V DC. The battery charger and battery shall comply with the relevant Codes, Standards or Regulations. Typically 24 hours standby battery backup is required followed by 30 minutes in an alarm condition.

1. UL 1481 Listed -provided the power supply and standby batteries have been appropriately sized / rated to accommodate the system's power requirements.
2. Provide 120-volt 20-amp circuit from the life safety branch panel to each power supply.

2.6 AUXILIARY EQUIPMENT MONITORING

A. The fire alarm system shall monitor for alarm, supervisory, and trouble conditions; and annunciate the status of the following equipment when provided, or is existing to remain, as part of this project. A failed status shall activate the trouble alarm.

1. Emergency Generator: Run Status
2. Emergency Generator: Trouble Signal
3. Fire Pump: Run Status

4. Fire Pump: Trouble Signal
5. Emergency Service Communications Systems, as required by NFPA 72 and NFPA 1221.

2.7 MAGNETIC DOOR HOLDERS, AUTOMATIC FIRE DOORS / SHUTTERS, AND SECURITY GRILLES AND INTERIOR SPACE CONTROLLED ACCESS EGRESS DOORS WITH AUTOMATIC EMERGENCY EGRESS ELECTRIC LOCK EMERGENCY RELEASE

A. Magnetic fire door hold open devices, interface for automatic roll down fire doors/shutters, and interface for security grilles and controlled access egress doors with emergency egress shall be provided. Coordinate with Division 8 and Architectural Drawings for exact location.

B. The operation of any alarm in the fire alarm system shall cause the following:
1. Release of the magnetic fire door holding devices, permitting the fire doors to be closed by the door closer.
2. Permit the automatic roll down fire doors/shutters to close automatically.
3. Permit the security grilles with emergency egress to open automatically.
4. Unlock the electrically controlled access doors in all interior spaces.

C. The magnetic door holders, automatic roll down fire doors/shutters, security grilles, and interior electrically controlled access doors with emergency egress, shall be associated with two smoke detectors located on the ceiling with one on either side of the fire door/shutter, security grille opening, or interior egress path electrically controlled door. The operation of either of these detectors shall also cause the magnetic holder to release the fire door, the automatic fire door/shutter to close, and the security grille with emergency egress to open.

D. The operation of smoke detectors associated with a magnetic door holder, automatic roll down fire door, security grille, or electrically controlled access door shall transmit a pre-alarm signal to the fire alarm panel.

2.8 REMOTE ALPHA-NUMERIC DISPLAY ANNUNCIATORS

A. Remote alpha-numeric annunciator(s) to annunciate all system events and duplicate the displayed status at the main FACP. The annunciator(s) shall be an alphanumeric display similar to the main FACP and operate via the system RS485 or RS232 serial output terminal from the main FACP. The unit shall operate from FACP 24VDC power and function during system power failure while the system resides on standby batteries. The remote annunciator(s) shall include:
1. Integral time-date clock
2. System reset
3. System silence
4. System acknowledge
5. Display/step switch
6. Integral trouble buzzer
7. LCD contrast adjust
8. Fire Drill Operation

B. Annunciator shall upon command display the first system alarm, last alarm, and system alarm count. The following primary controls shall be visible through a front access panel:
1. 80 character alphanumeric display, LCD, LED, or gas plasma
2. Individual red system alarm LED
3. Individual yellow supervisory service LED
4. Individual yellow trouble LED

5. Green “POWER ON” LED
6. Alarm acknowledge key
7. Trouble acknowledge key
8. Alarm silence key
9. System reset key
10. LED test

2.9 REMOTE PAGING UNIT

A. Remote all-call paging unit or to activate one of the pre-recorded messages over the speaker circuits.

2.10 PRINTER AND PRINTER STAND

A. Printer and printer stand not required by owner.

PART 3 – EXECUTION

3.1 GENERAL REQUIREMENTS

A. Installation shall include the delivery, storage, setting in place, fastening to the building structure, interconnection of the system components, alignment, adjustment and all other work, whether or not expressly specified, which is necessary to result in a tested and operational system.

B. All installation practices shall be in accordance with, but not limited to, the specifications and drawings. Installation shall be performed in accordance with the applicable standards, requirements and recommendations of NFPA 72 and the National Electrical Code and any authorities having jurisdiction. Proper protection against corrosion shall be provided on all electrical equipment in accordance with the requirements of the National Electrical Code. The installation shall conform to all manufacturers’ recommendations.

C. All equipment shall be firmly secured in place unless requirements of portability dictate otherwise. Fastenings and support shall be adequate to support their loads with a safety factor of at least three.

D. All boxes, equipment, etc., shall be plumb and square. The contractor must take such precautions as are necessary to prevent and guard against electrostatic hum, to supply adequate ventilation, and to install the equipment to provide reasonable safety for the operator.

E. In the installation of equipment and cables, coordinate with Architectural drawings for possible conflicts with millwork, casework, marker boards, furniture, lockers, etc., and notify the architect of any discrepancies. Verify modifications before proceeding with installation.

F. Mount end-of-line resistor for each box circuit in backbox located at the last manual alarm station or automatic initiating device in a circuit. Mark device accordingly in the field.

G. Provide three dedicated Cat 6 cables from MDF/IDF to fire alarm panel. Cable shall be installed in 3/4" conduit. Two cables for phone POT lines and one Ethernet data connection.

H. Upright and/or Wall Post-Indicating Valve: Provide conduit and wiring from fire alarm control panel to post-indicating valve if electronically supervised, coordinate exact

location of PIV with fire sprinkler contractor prior to rough-in. Coordinate final location with Civil Drawings and Fire Protection Contractor. Where equipment is located inside a vault, stub required conduit inside vault, turn up and cap.

I. Contractor shall submit on completion of system verification, a point-by-point check list indicating the date and time of each item inspected and issue a certificate confirming that the inspection has been completed and the system is installed and functioning in accordance with the Specifications prior to date of substantial completion.

J. Provide remote alphanumeric display annunciators in the administrative area in constantly attended area and additional annunciators where indicated on the drawings.

K. Provide remote paging units adjacent to each remote alphanumeric display annunciator for voice alarm systems.

L. Alarm devices shall be ceiling mounted unless indicated specifically otherwise. Alarm devices in Mechanical, Electrical, Communications, IDF / MDF Rooms and Central Plant shall be wall mounted and coordinated with other equipment, piping and ductwork.

M. Provide combination speaker strobes. Provide strobe only alarms when additional speaker placement will compromise voice intelligibility. Provide horn/strobes in coolers and freezers.

N. Detectors shall be installed per NFPA 90A and be listed with the fire alarm control panel.

O. Auxiliary Equipment Monitoring Wiring and connection to equipment shall be the responsibility of the fire alarm contractor.

P. Power for magnetic door holders shall be wired through fire alarm relay.

Q. Smoke detectors shall be mounted to a 4-inch octagon box with hanger bar or with box secured to building structure.

R. Provide power via 120-volt, 20-Amp dedicated circuits with lock-on provisions at the respective circuit breaker for the main fire alarm control panel, each panel extender and each remote power supply at no additional cost to the Owner. The complete fire alarm system shall be powered under emergency power when emergency life safety power is available at the project site. When emergency life safety power is not available at the project site, power shall originate from the nearest available 120-volt panel. Label 120V circuit origination (i.e.: “120-Volt Circuit ELA-3”)

S. Provide smoke detectors in the following locations:
   1. All paths of egress and adjoining spaces within the same HVAC envelope including but not limited to: corridors, hallways, stairs, lobbies, and elevator landings.
   2. At each electrical room, telecommunications/data room, elevator machine room, kiln room, and mechanical room not subject to un-treated or un-filtered outside air.
   3. At each computer lab/room.
   4. At each library, library office and library ancillary areas.
   5. At each storage room, stock room, or warehouse space.
   6. At each pre-K and kindergarten classrooms.

7. At nurse's area/clinic and patient care/cot areas.
8. At each men's and women's restroom/toilet
9. At each administrative work room or copy room.
10. At each student toilet / restroom. Provide STI protective cover. Do not locate over plumbing fixtures or near partitions.
11. At each special needs, life skills, adaptive behavior, developmental classrooms or similar designated areas without food preparation or cooking equipment.

T. Provide heat/thermal detectors in the following locations:
1. At each electrical room, telecommunications/data room, elevator machine room and mechanical room subject to un-treated or un-filtered outside air.
2. At each janitor's/custodial closets and laundry rooms.
3. At each commercial kitchen and adjoining storage rooms; at each food preparation area.
4. At each employee break room/lounge.
5. At each vocational shop.
6. At each science, physics, chemistry, or biology classroom and their associated preparation and storage rooms.
7. At each special needs, life skills, adaptive behavior, developmental classrooms or similar designated areas with food preparation or cooking equipment.

U. Provide carbon monoxide detection and smoke detection devices in all areas designated as day-care for minors.

V. Provide duct smoke detectors in all air handling units with air volumes of 2,000 cfm or larger. Where duct smoke detectors are installed above ceilings, provide external remote status/alarm LED mounted flush with ceiling in close proximity to the duct detector location. If space is open without ceiling, wall mount remote status/alarm LED in close proximity to the detector between 96 and 108-inches AFF, or as directed by Owner.

W. Provide duct smoke detectors on outside air units only as required by local Code and / or A.H.J.

X. Provide VESDA type detectors at the following locations when appropriate:
1. Atriums.
2. High ceiling corridors where maintenance of spot type detectors may be difficult.
3. Areas with skylights.
4. Auditorium Stage
5. Auditorium Seating
6. Main corridor in front of Auditorium

Y. Provide manual pull stations at FACP in MDF and adjacent to Fire Alarm Annunciator(s) only, unless required by code otherwise.

Z. Provide weatherproof exterior audio/visual alarm devices mounted on the building at the exact location as directed by Architect:
1. Main entry.
2. Courtyards and outdoor assembly areas adjacent to the building.
3. Mechanical yards adjacent to the building.
4. Covered playgrounds or covered assembly areas adjacent to the building.
5. Additional locations where indicated on drawings.
6. Outdoor paved play areas.

AA. Provide audio and visual alarm devices in all areas normally occupied by students or minors and all common use areas.

BB. Provide carbon monoxide detection in classrooms and other instructional spaces served by a fuel-burning appliance, fuel-burning HVAC equipment (including roof mounted equipment), or with gas fuel outlets for connection to portable fuel-burning space heaters and appliances such as Bunsen burners which are typically used in laboratories or science classrooms.

CC. Provide smoke detectors, pull stations with stopper covers, and speaker strobes in each classroom in all portable buildings, tied into the main campus fire alarm control panel.

DD. Provide properly rated and grounded surge suppression for all circuits leaving and entering the building.

3.2 CABLE AND BOXES INSTALLATION

A. All fire alarm wiring to be red. All fire alarm circuits shall be identified at each termination and at each 25 feet between terminations. Minimum Wire size shall be as follows:
   1. Initiating Circuits: 18 AWG
   2. Strobe Circuits: 14 AWG
   3. Relay Control Circuits: 18AWG
   4. Voice/Speaker Circuits: 16 AWG

B. All circuits shall be protected to avoid interruption of service due to short-circuiting or other conditions, which might adversely affect the connected devices. Each individual signaling circuit shall be classified as a circuit pair.

C. All cabling in racks, cabinets and junction boxes shall be neatly strapped, dressed and adequately supported. Cable installation shall conform to good engineering practices and to the standards of the National Electrical Code.

D. Cables shall be terminated with the proper connector required for the associated operation of the equipment to which it is connected. Screw terminal blocks shall be furnished for all cables, which interface with racks, cabinets, consoles or equipment modules.

E. All cables within a rack, console or junction box shall be grouped according to the signals being carried to reduce signal contamination.

F. Where shielded conductors enter a panel or enclosure, and where power wiring exists, provision shall be made to provide physical isolation of signal and power conductors.

G. Supply and install all fittings and accessories whether or not they are specified, required for proper, safe and reliable operation of the system.

H. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit fill shall not exceed 40%.

I. Minimum conduit size shall be 3/4" EMT with insulated bushings. Install conduit per engineered shop drawings. All conduit terminations in all boxes shall have insulated bushings.

J. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed to view and or subject to damage.

K. All vertical wiring and all main trunk/riser wiring shall be installed in a complete raceway/conduit system. All riser boxes shall be adequately sized for the number of conductors transversing the respective box as well as the number of terminations required.

L. All junction boxes containing fire alarm wiring are to be painted red and labeled.

M. All plenum wiring is to be installed parallel and perpendicular to the building structure. Cable shall be bundled with plenum rated cable zip ties on a maximum of 2'-6". Install cable in D-ring hangers, secured to the structure at a maximum of 5' on center. Cable shall not lie on ceiling grid or ceiling tiles, light fixtures, piping, ductwork, or foreign equipment.

N. The system ground is to be connected to the local ground bus. Under no conditions shall the AC neutral either in a power panel or in receptacle outlets be used for a reference ground.

O. All wiring shall be in accordance with NFPA 72, the National Electrical Code, and Local Codes. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings.

P. All wire shall be UL Listed FPL for limited energy (300V) and fire alarm applications and shall be installed in conduit. Limited energy FPLP or MPP wire may be run open in return air ceiling plenums provided such wire is UL Listed for such applications and is of the low smoke producing fluorocarbon type and complies with NEC Article 760 and approved by the local authority having jurisdiction.

Q. No other wiring shall be run in the same conduit as fire alarm wiring.

3.3 FINISHES

A. Main Fire Alarm Panel color shall be approved by Owner / Architect.

3.4 ALARM SYSTEM SEQUENCE OF OPERATION

A. General:
   1. All fire alarm circuits shall be electrically supervised.
   2. Automatic response functions shall be accomplished by the first device initiated. Alarm functions resulting from initiation by the first device shall not be altered by subsequent alarms. An alarm signal shall be the highest priority. A pre-alarm signal shall have second priority and supervisory or trouble signals shall have third and fourth level priority. Signals of a higher level priority shall take precedence over signals of lower priority even though the lower priority condition occurred first.

B. Fire alarm operating sequences shall be as follows:
   1. Activation of any automatic detector, manual station, fire suppression system, sprinkler flow switch or any other system required by NFPA 72 to be monitored to initiate an alarm condition shall cause the location of the alarm to be identified in an audible and visual manner at the building fire alarm control

panel (FACP), and shall initiate the following events:

a. The system common alarm LED on the CPU Module shall flash. The internal audible trouble device shall sound. Acknowledging the alarm condition shall silence the audible trouble device and revert the flashing common alarm LED to a steady state.
b. The alphanumeric display shall indicate all applicable information associated with the alarm condition including: zone, device type, device location, and time of alarm. Location and zoning messages shall be custom field programmed to respective premises.
c. Any remote or local annunciator LED's associated with the alarm point shall be illuminated as herein specified.
d. The remote signaling connection shall be activated relaying the alarm signal to an approved central station (central station connection and service provided by Owner). Point ID and descriptor must be sent and received.
e. All automatic events programmed to the alarm point shall be executed and the associated indicating devices and/or outputs activated.
f. Activate all audible/visual alarm devices. Where prerecorded voice announcement is required or specified, the prerecorded announcement shall be preceded with attention tone(s), followed by the approved prerecorded announcement and continue in a cycle until the system is reset. Manual voice announcement shall interrupt the prerecorded cycle and the prerecorded cycle shall resume automatically after three minutes.
g. De-activate all HVAC systems including low speed high volume (LSHV) circulating blade type fans.
h. De-energize the kitchen hood supply/exhaust fans as required by local authority having jurisdiction.
i. Close all related smoke dampers.
j. Close all related smoke/fire dampers.
k. Release all magnetic door hold open devices.
l. Release the electric strike, unlocking, but not unlatching, locked doors controlled by an access control system.
m. Release Counter Shutters and hold-open devices on all fire and smoke doors.
n. Open all security grilles with emergency egress.
o. Activate to close all related fire and smoke doors and shutters.
p. Activate signaling connection to the elevator as required by the local authority having jurisdiction.
q. Signal the building automation system and Owner’s security/police personnel as directed by Owner/Architect. The audible alarms shall be inhibited from being silenced for a period of 3 minutes after commencing operation unless alarm is acknowledged and appropriate action has been taken.
r. Activate automatic recall operation of elevators as required by local authority having jurisdiction.
s. Record all events on the system printer.

2. Activation of duct mounted smoke detector on the HVAC equipment, or a smoke detector mounted in the return/supply air stream of any fan shall shut down all units as required by NFPA. The activation of one of these detectors shall send an alarm signal to the control panel and also initiate the Alarm Sequence of Operation.
3. Activation of a control valve supervisory switch shall initiate the following events:
   a. The activation of any sprinkler valve supervisory (tamper) switch shall

activate the system supervisory service audible signal and illuminate the LED at the building fire alarm control panel (FACP). Differentiation between valve tamper activation and opens and/or grounds on the initiation circuit wiring shall be provided.

b. Activation of a sprinkler system control valve supervisory switch shall not prevent the events listed under Article 3.4.

c. Restoring the valve to the normal position shall cause the supervisory service audible signal to pulse, indicating the restoration to normal position. The supervisory service reset key shall be provided to silence the audible signal.

4. Activation of the smoke detector and heat detector in the elevator machine room and at top of elevator shaft shall cause the elevators' controllers to be tripped by way of the shut trip breaker, and shall also initiate the events listed under Article 3.4.

5. Any subsequent fire alarm shall reactivate the alarm indicating appliances and activate the respective control sequences described above.

6. Upon reset of the fire alarm control panel, HVAC units shall be capable of being started, and resume normal operation.

7. When the fire alarm panel is in alarm, the fire alarm panel shall signal the digital lighting control system, as required, to activate and turn all lights to full bright in all NFPA 101 paths of egress and as required by the Fire Marshall. Once the fire alarm (or drill) is cleared, the fire alarm panel shall signal the digital lighting control system as required to enable the digital lighting control system to revert to normal operation with the lights to remain illuminated until manually turned off using the digital lighting control system.

C. Activation of the manual evacuation (drill) switch shall operate the alarm indicating appliances without causing other control circuits to be activated. However, should true alarm occur, all alarm functions should occur as described.

D. ALARM VERIFICATION shall be field programmed for each respective detector. Global verification will not be acceptable. The verification sequence is activated after a "check" procedure and the panel will wait a field programmable delay period (0-50 seconds) then proceed to re-sample the detector for continued presence of smoke. If the alarm condition still exists or a non-verified device is actuated during the verification period, the system will then initiate all alarm sequences specified herein. The system shall incorporate the ability to log in memory the number of verification events that have occurred for each selected device.

3.5 EQUIPMENT IDENTIFICATION

A. Each panel or equipment enclosure shall be provided with a permanently engraved or embossed or silkscreen identification tag. The tag shall include the following information:

1. Name of manufacturer.
2. Manufacturer's equipment description.
3. Serial number and model number.
4. Voltage and current rating.

B. All addressable devices shall be labeled with point and module number. Provide label maker style label on base of device. Verify exact requirements with Owner.

3.6 SPARE PARTS AND TOOLS

A. Interchangeable Parts: All spare parts furnished shall be directly interchangeable with the corresponding components of the installed system. Spare parts shall be packaged

and identified by nameplate, tagging, or stamping. Spare parts shall be delivered to the site in unopened cartons for storage as directed by the Owner.

B. Spare Parts: Provide minimum of two, or 5% of building total, whichever is greater unless noted otherwise.
   1. Spare shut down modules
   2. Spare detectors of each type in the system
   3. Spare alarm indicating devices of each type in the system
   4. Spare manual pull stations
   5. Spare protective covers of each type in the system.
   6. Spare relays/controls required for connection to smoke and fire/smoke dampers
   7. Devices listed above are to be installed as directed by Architect/Engineer or local code authorities at no additional cost to the Owner. Unused spare parts are to be parts for Owner's cabinet.

C. Provide one smoke, heat and carbon monoxide detector testing kit. SDfire #TF2823 with Solo Testfire #2001 tester with 15-foot access pole and three 4-foot pole extensions, detector removal tool, and carrying bag.

D. Provide two copies of the final software programmed into the fire alarm system.

E. Parts list: Furnish a list, in duplicate, of all other parts and accessories the manufacturer of the system recommends to be stocked for maintenance.

3.7 KEYS

A. Keys and locks for all equipment shall be identical. Provide not less than six keys of each type required. Identify keys by an appropriate number stamped on each key or on a metal tag attached thereto. Provide a key numbering chart in each operation and maintenance manual furnished.

3.8 SMOKE DAMPERS AND FIRE/SMOKE DAMPERS

A. Smoke dampers and combination fire/smoke dampers shall be controlled by an automatic alarm initiating device. Smoke dampers installed to isolate the air handling system shall be arranged to close automatically when the system is in alarm.

B. Coordinate motor operator voltage with supplier.

C. Open all dampers prior to starting air handling equipment.

D. Provide 120V power from nearest general purpose 20A receptacle circuit as required, or as noted otherwise.

3.9 GRAPHIC FLOOR PLANS

A. Provide two (2) color coded floor plan detailed with project name, actual room names, actual graphic room numbers as directed by the Owner and adequate information to direct people to the fire alarm devices in alarm and to exits with non-fading floor plan media. Do not use architectural plan room names and numbers.

B. Each plan shall clearly relate the room numbers on the annunciator to the area description on the floor plan. All fire alarm devices located to correspond with the annunciator. Indicate location of all end-of-line resistors.

C. Provide graphic floor plans with all fire alarm devices and equipment, with labels and addresses matching system programming and reporting. The floor plan shall be provided in lexan protective covering and framed.
   1. Minimum size 30x42 inches, mounted adjacent to FACP in MDF and at remote annunciator.
   2. Provide digital copy of graphic floor plan in AutoCAD (.dwg) format.

D. Provide and mount framed signed FML certificate adjacent to FACP.

3.10 OPERATING INSTRUCTIONS

A. Coordinate with Owner for appropriate off-site monitoring service and communication technology to be used. Provide all necessary programming for interfacing with the Owner's on-site and off-site remote signaling receiving station, including programming of descriptors and addresses at the receiving station.

B. Provide Fire Alarm System Operating Instructions for the following items including, but not limited to:
   1. Alarm Signal
      a. How to open panel door
      b. What to read and follow the instruction on display
      c. How to acknowledge alarm
      d. How to silence the signals
      e. How and when to reset the system
      f. How to return system to normal operation
   2. Trouble / Supervisory
      a. How to open panel door.
      b. What to read and follow the instruction on display
      c. How to acknowledge trouble condition
      d. Appropriate personnel to respond

C. Provide laminated instructions in extruded aluminum frame. Mount adjacent to the Fire Alarm Control Panel and remote annunciator panel(s) for ready reference.

3.11 ADDITIONAL REQUIREMENTS

A. For campuses with existing fire alarm systems, the existing fire alarm system shall remain fully functional and monitored until the new system is fully installed, inspected, and accepted by the AHJ and owner.

B. The contractor is to ensure all areas of the building are covered with visual and audio alarm devices for occupant notification of a fire alarm, including remote portable or temporary buildings.

C. Coordinate door hold devices with door and door hardware.

D. Provide interface with and coordinate shunt-trip circuit breakers and control devices with kitchen hood fire control systems and elevator equipment.

E. Alarm circuit power supplies and circuiting shall be designed and installed to accept an additional five (5) 110cd visual devices for future expansion. The initial design shall not exceed 70% of the rated power supply and circuit capability.

F. Install system event printer as directed by Owner/Architect.

G. Provide programming or re-programming of all hot keys as directed by Owner

including, but not limited to, fire drill, AHU shutdown bypass, horn/strobe disable, elevator test.

H. Provide one dedicated alarm circuit for (future) portable (temporary) building(s) to the nearest main building egress exit discharge to the designated portable building location. Provide 100 feet of cable coiled and marked “FACP-ALARM-PORTABLES” above an accessible ceiling.

I. Provide one dedicated addressable initiating device circuit with a minimum capacity of 50 devices for (future) portable (temporary) building(s) to the nearest man building egress discharge to the designated portable building location. Provide 100 feet of cable coiled and marked “FACP-INITIATING PORTABLES” above an accessible ceiling.

J. Provide printer and printer stand at main FACP; exact location as directed by Owner / Architect.

K. Provide control module relays to interface with the digital lighting control system; refer to specification Section 26 09 28 Digital Lighting Control System. Provide Form C dry contacts to indicate1) Fire alarm (including fire drill activation) and 2) Fire Alarm cleared.

L. Provide 40 initiating devices and two audible circuits for portable buildings. These shall be used to service existing portable buildings and remainder shall be left as spare above accessible ceiling.

3.12 COMMISSIONING THE SYSTEM

A. The installing contractor shall be responsible for verifying that each component of the system is fully operational and in conformity with the specifications. He shall also be responsible for insuring that all elements function together as a system in accordance with the specifications.

B. A state licensed NICET II minimum and factory trained technical representative of the manufacturer shall supervise the final control panel connections and testing of the system. Upon completion of the acceptance tests, the owner and/or his representatives shall be instructed in the proper operation of the system.

C. The installing contractor shall functionally test each and every device in the entire system for proper operation and response. Field testing shall include voice intelligibility as required by the latest edition of NFPA 72 Any items found not properly installed or non-functioning shall be replaced or repaired and retested. The final test indicating a fully functional fire alarm system shall be recorded and an electronic Excel and printed copy submitted to the Architect, Engineer and Owner.

D. The installing contractor shall provide a complete written report in electronic form and printout of the functional test and intelligibility test of the entire system. A copy of the test report shall be provided with the Maintenance and Operation Manuals. The test report shall be signed and dated by the licensed fire alarm superintendent responsible for supervising the final system test and checkout. This test shall be witnessed and accepted by the Owner prior to testing for the local Fire Marshall.

E. The installing contractor's fire alarm superintendent shall test the entire system in the presence of the local authorities having jurisdiction. The contractor shall be responsible for making any changes, adjustments, or corrections, as may be required by the local authorities. The Contractor shall affix his certification label and installation certificate to the interior of the main fire alarm control panel.

F. The testing and acceptance shall be performed within 30 days after the fire alarm installation is completed. The test shall be performed by a minimum of two qualified fire alarm system technicians acceptable to the authority having jurisdiction. The test which is a comprehensive 100 percent inspection and test of all fire alarm system equipment shall include the following:

1. Fire alarm control equipment: a visual and functional test of the fire alarm control and auxiliary control equipment.
2. A visual inspection shall be conducted to establish that all electrical connections and equipment, as required, are properly installed and operating.
3. A functional fault simulation test shall be conducted on all relevant field wiring terminations to ensure that wiring is properly supervised as required.
4. Indicators shall be tested to ensure proper function and operation.
5. Control panel auxiliary functions shall be functionally tested to verify proper operation.
6. Control panel supervisory and alarm current readings shall be taken to verify that the control panel has the appropriate power supplies and standby batteries to operate the system as required. A three-minute general alarm stress test, both under AC power and standby power, shall be conducted to further ensure complete operation of the system.
7. Fire alarm peripheral devices; All fire alarm peripheral devices shall be functionally tested and the location and testing information recorded for each device.
8. Manual initiating devices:
    a. Each manual fire alarm station shall be functionally tested for alarm operation.
    b. Each manual fire alarm station shall be functionally tested for proper wiring supervision.
9. Automatic initiating devices:
    a. Each automatic initiating device shall be activated in accordance with manufacturer’s instructions to ensure proper operation.
    b. Each automatic initiating device shall be functionally tested for proper wiring supervision.
    c. Each automatic initiating device shall be inspected to ensure proper placement and mounting as required by specifications.
10. Alarm signaling devices:
    a. Each alarm signaling device shall be tested and decibel reading taken at 10' from the device and recorded to ensure proper operation. Each area’s voice alarm signaling devices shall be tested for intelligibility.
    b. Each alarm signaling device shall be functionally tested for proper wiring supervision.
    c. Decibel reading shall be taken to ensure that the alarm signal level can be clearly heard in all areas of the facility.
    d. All visual alarm indicators shall be functionally tested to ensure proper operation and that they are clearly visible.
11. Elevators: Each elevator shall be tested and automatic recall function verified.
12. Reporting: Upon completion of the initial verification audit, a report shall be sent to the Architect/Engineer indicating that all fire alarm equipment has been tested and is in 100 percent operation. The report shall also contain the audit testing information as to the location and operational status of each peripheral device. The 100 percent audit shall be performed by a factory-trained representative. The report shall include the voice intelligibility performance in each area and indicate compliance with NFPA and local AHJ requirements.

G. It is the intent of these specifications and of the Architect/Engineer that a continued

program of system maintenance is to be provided by the Owner in compliance with NFPA 72. It is mandatory that the installing Contractor provide such services and make available these services to the Owner upon completion of the project.

H. Upon completion of installation and full acceptance testing, submit NFPA 72 certificate of compliance that the total fire alarm system, including any subsystems, is fully functional and that the components are UL listed for function intended.

3.13 SUBSTANTIAL COMPLETION

A. Final acceptance of the FIRE ALARM SYSTEM by the owner, local code authorities and Occupancy Permit has been issued.

B. All fire alarm system shop drawings, test reports, operating and maintenance manuals, maps and as-built drawings shall be submitted in electronic format to and accepted by the Architect / Owner prior to date of substantial completion.

C. Acceptance by County or Local Fire Marshall.

3.14 WARRANTY

A. The fire alarm system, including labor and material, shall be free from defects in workmanship and materials, under normal use and service, for a period of one year from the date of substantial completion. Major components including but not limited to the main fire alarm panel, sub-panels, panel extenders, power supplies and emote annunciators. Any equipment or workmanship shown to be defective shall be repaired, replaced or adjusted during normal working hours at no cost to the owner within 4-hour notification. Any equipment replaced shall be complete with full factory warranty for that part beginning on the date of installation.

B. Repair services and replacement parts for the system to be furnished under this Contract shall be available for a period of ten years after the date of final acceptance. Service during the warranty period shall be provided within four hours after notification and all repairs shall be corrected within 24 hours after notification throughout the warranty specified in this section.

C. The installing contractor shall provide 24 hour, 365 days per year emergency service with factory trained, state licensed service technicians.

D. The equipment manufacturer shall be represented by a local service organization and the name of such shall be furnished to the Owner, Architect, and Engineer.

E. Provide a certified fire alarm test of the complete system no earlier than 30 days prior to the end of the warranty period and correct any and all items to bring the system to an approved status at no cost to the Owner. Clean all smoke detectors and replace all defective parts at no cost to the Owner.

F. Guarantee labor, materials, and equipment provided under this contract against all defects for a period of one year after the date of final acceptance and receipt and approval of “As-Built” drawings and schematics of all equipment.

G. All manufacturer’s warranties which extend past final completion shall be fully transferred to the Owner.

3.15 TRAINING

A. Provide training course to all fire personnel assigned by Owner's Representative. The training shall include a course syllabus and hands-on participation. Training shall be conducted on a system identical to the one being installed on this project. The system shall be able to perform all system operations and simulate all types or forms of alarm conditions.

B. Provide a video of the training program to the Owner's Representative to be used for periodic refresher course, training of the local fire department and for training of new employees.

C. The training course shall include, in addition to the above, a system overview, and a review of the operation and maintenance manual.

D. The instructor shall be factory trained and shall be thoroughly familiar with all parts of the installation on which instruction is to be given. The instructor shall be trained in operating theory as well as in practical operation and maintenance work.

END OF SECTION

SECTION 28 55 00

RF SURVEY FOR IN-BUILDING EMERGENCY RESPONDER RADIO COVERAGE (ERRC)
AND
TESTING OF EXISTING ERRC ENHANCEMENT SYSTEMS (EERCES)

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The purpose of this specification is to establish the requirements and standards for surveys for public safety radio signal strength in buildings as required by the NFPA, IBC, IFC and local AHJ. This specification is only for a RF survey. If an existing ERRCES is on premise and is operational, provide verification and documentation of the existing ERRCES as specified.
   1. This survey is required as part of the contract documents and shall be implemented as specified in this specification unless indicated or specified otherwise.
   2. This survey is required for in all buildings with basements, all buildings four stories and taller, and all buildings with an aggregate total building area of 50,000 square feet or more; this survey may still be required for other buildings that do not meet these structural requirements.
   3. This survey may not be required if the local AHJ has pre-determined that an Emergency Responder Radio Coverage Enhancement System (ERRCES) is not required for the subject building(s). If a survey is not required by the AHJ, notify the Architect, Engineer, Owner prior to scheduling the survey.
   4. The survey requirements specified in this section are intended to be slightly more stringent than minimum IBC and IFC requirements. This is to help mitigate radio coverage deficiencies that could be caused by future minor variations in building use configurations and changing atmospheric conditions.

B. Where the subject building(s) do not have an existing ERRCES, this survey shall be for ERRC measurements and compliance evaluation only, it is not intended as a requirement for designing nor a requirement for providing an ERRCES.

C. Where the subject building(s) have an existing and operational ERRCES, this survey shall include a full yearly functionality test of the existing ERRCES hardware, antennae, wave guides, cabling, wiring, and connectivity as required by the local AHJ, IBC, IFC, and NFPA. This survey shall then be able to be used for the required yearly inspection and testing report of the existing ERRCES. If deficiencies of an existing ERRCES are observed or detected during field signal measurement, the contractor shall document those deficiencies and report them to the Owner in writing within two Owner’s business days of completion of the testing so that the Owner can take immediate remedial action. Corrections and modifications to existing ERRCES are not part of this specification section requirements.

D. Technical information for this survey shall be obtained from the local AHJs pertaining the specific technical information and requirements for the emergency responder communications coverage system. This information shall include but not be limited to the various frequencies required, the location of radio antennae sites, the effective radiated power of the AHJ radio antennae sites, the maximum propagation delay in microseconds, the applications being used, and other supporting technical information that would be necessary for an ERRCES design and to fully test an existing ERRCES.

E. Surveys for new construction shall be performed after the building is fully dried in, with interior wall construction and all exterior wall glazing completed, and prior to start of installation of electrical wiring. It is the intent that this survey be completed as soon as practical, results reported to the Owner and analyzed, and if required or specified as part of the contract documents or if it is to be provided by others, a radio antenna/repeater system can be designed, installed, fully operational, and commissioned without delaying the scheduled contract date for certificate of occupancy (CO) or the AHJs final inspection and approval for full Owner and public occupation of the building.

F. Conduct surveys using a RF Spectrum Analyzer, a calibrated system-compatible radio or another suitable instrument with traceable certificate of calibration to analyze the RF signal strength of Emergency Responder Radio Signal into the building and determine if amplification of the signal is required or that if existing, the existing ERRCES is functioning properly and providing the proper radio coverage. All test equipment shall have been calibrated within the previous 12-months of the date(s) of testing. Both inbound and outbound signal strength shall be determined, measured, calculated, and documented as required by code. General weather conditions and time of day during the test shall be documented as part of the survey report.

1.2 SURVEY CRITERIA

A. The required Public Safety Radio Signal Level inside the Owner's facility shall be as required by code, ordinance, AHJ, and as specified.

B. Survey shall be performed by an FCC licensed technician holding a current General Radiotelephone Operator License (GROL). Where required by the local AHJ, the licensed operator shall be registered with the AHJ as an ERRC Special Inspector (or equivalent designation given by the AHJ) with in-building emergency radio system certification issued by a nationally recognized organization, school, or the emergency radio system manufacturer of the equipment being tested where an existing ERRCES is being tested, or certification by the ERRCES if a new ERRCES is specified elsewhere to be installed as part of the contract documents.

1.3 REGULATIONS

A. Codes, regulations, and standards shall be the latest published standards. The latest national published standards listed below shall supersede any local standard unless doing so would violate the intent of the local code requirements.
   1. NFPA 1 – Fire Code
   2. NFPA 70 – National Electrical Code
   3. IFC 510- Emergency Responder Radio Coverage
   4. NFPA 101, Life Safety Code, and all local amendments and requirements.
   5. NFPA 72 National Fire Alarm and Signaling Code
   6. FCC 47 CFR Telecommunications
   7. FCC 47 CFR 90.219 Use of Signal Boosters
   8. IFC - International Fire Code
   9. Local or State Fire Codes
   10. ADA "Americans with Disabilities Act" and any local or state or local accessibility standards and amendments.
   11. FCC's OET 65 Standards "Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields"
   12. FCC Rules Part 22 Public Mobile Services, Part 90 and Part 101
   13. NFPA 1221- Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems

14. IBC - International Building Code
15. UL 2524 - Standard for In-building 2-Way Emergency Radio Communication Enhancement Systems
16. NFPA 3000 (PS) - Standard for an Active Shooter/Hostile Event Response (ASHER) Program and if present, Owner's specific ASHER Program. Note: Although currently considered by the NFPA as a Provisional Standard (PS), the issued NFPA 3000 shall be considered part of this specifications as if it were a fully accredited document to NFPA standards. If the building Owner has established an ASHER Program, it too shall be considered part of this specification section requirements.

1.4 DEFINITIONS

A. Definitions:

1. Area: A enclosed space in a building consisting floor to ceiling walls with doors.
2. ASHER Program: Active Shooter Hostile Event Response Program. Program elements developed by the building's Owner to determine the necessary functions and actions related to preparedness, response, and recovery from an active shooter/hostile event response.
3. BDA: Bi-Directional Amplifier. A device used to amplify band-selective or multi-band RF signals in the uplink, to the base station and in the downlink from the base station to subscriber devices for enhanced signals and improved coverage.
4. BER: Bit Error Rate is the number of bit errors per unit time
5. DAS: Distributed Antenna System
6. ERRCES / ERRCS: Emergency Responder Radio Coverage Enhancement System / Emergency Responder Radio Coverage System. A two-way radio communication system installed to assure the effective operation of radio communications systems for fire, emergency medical services, or law enforcement agencies within a building or structure. A system used by firefighters, police, and other emergency services personnel.
7. FCC: Federal Communications Commission
8. Grid or test grid: The individual specified and/or code required imaginary spaces inside the building used for radio coverage testing. Typically a grid space consist of a square space with equal or almost equal side dimensions where the radio signal levels are measured at the center of each grid space to verify radio coverage. Grid spaces can consist of individual areas or rooms meeting the maximum size requirements.
9. GROL- FCC General Radiotelephone Operators License
10. OET 65 Standards: FCC's Bulletin 65 provides Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.
11. Public Safety/First Responder: Public Safety or First Responder agencies that are charged with the responsibility of responding to emergency situations. These include, but are not limited to law enforcement departments, fire departments, and emergency medical companies. Typically, there may be multiple agencies for each type of responder, including those administered by the building Owner.
12. RSSI: Received signal strength indicator RSSI is a relative measurement of the power present in a received radio signal.
13. Zone: The individual partitioned grid specified and/or code required imaginary space(s) inside large buildings. Typically, each zone shall be no more than 50,000 square feet and shall be contiguous on the same building floor. Zones are further sub-divided into smaller grid spaces so that radio signal levels can be measured at the center of each grid space to verify radio coverage. A zone

can be an individual wing of a building or separate floors of a building that do not exceed 50,000 square feet each. Zones can be created for separate test report areas to ensure individual grid test spaces are not excessive in physical area size and detrimental to the accuracy and resolution of the test data measurement point locations. Each zone must pass the radio coverage test for the entire building to pass the test. Zones can exceed 50,000 square feet as long as the maximum allowable grid space size is not exceeded.

PART 3 – EXECUTION

3.1 EXECUTION

A. Testing Procedures and Parameters

1. The test shall be conducted using a calibrated portable radio authorized by the local AHJ, and of the latest brand and model used by the agency talking through the agency's radio communication system.
2. Testing shall include all critical areas required by the NFPA 1221 and others included in the list below. Critical areas shall be provided with a minimum 99-percent floor area radio coverage in each specific area. Critical areas include but are not limited to the following areas:
    a. Fire command centers
    b. Fire pump rooms
    c. Exit stairs
    d. Exit passageways
    e. Elevator lobbies
    f. Areas of rescue or refuge
    g. Areas with or spaces adjacent to standpipe cabinets
    h. Areas with or spaces adjacent to sprinkler sectional valve locations
    i. Areas with or spaces adjacent to bleeding control kits.
    j. Areas with or spaces adjacent to Automatic External Defibrillators (AEDs) for public use.
    k. Areas designated for persons with special needs or areas for specifically designated for persons who are not ambulatory including those in wheelchairs but require physical assistance by others to evacuate the building.
    l. Specific bullet resistant areas or spaces designated by the Owner or designated in the Owner's ASHER Program as a bullet resistant panic and safe room/areas or spaces.
    m. Front lobby areas and/or building administrative areas with direct wired microphone or wired telephone handset access to the building's mass notification or building wide communication system when such system is existing or to be installed as part of this project.
    n. Areas and/or building administrative areas with public safety radio base stations used for direct communications with Owner's police or security personnel.
    o. Other areas deemed critical by the AHJ.
3. Testing grid spaces, areas, and zones shall be as required by the local AHJ and/or as specified in this specification. The more stringent requirements of the local code, AHJ, or those specified or indicated elsewhere in the contract documents shall apply. Specific requirement for the test grids, areas, and zones shall be follows:
    a. Testing shall be based on a minimum of 20 approximately equal size grid spaces per floor or zone with a maximum of 2,500 square foot per test space. Failure of more than one test space shall be considered a test failure.

b. In the event that only two test spaces fail the 20-space grid test above, the same floor/zone shall be divided into 40 approximately equal size grid spaces or a maximum of 1,250 square feet per space and re-tested. Failure of only one or only two nonadjacent test spaces on that floor or zone shall result in a non-failure for that floor or zone. Failure of three or more spaces shall result in a test failure for that floor or zone. Failure of two adjacent test spaces shall result in a test failure of that floor or zone.

4. If there is an existing ERRCES and there are grid space test failures resulting in a failed test, notify the Owner in writing immediately about the failed spaces after the completed test and identify the specific areas of the building that are not compliant. The final test result formal submittal data may be submitted at a later date as specified. Contractor may provide recommendations for alterations or modifications to the existing system to the Owner/Architect/Engineer so that the deficiencies can be addressed by the Owner as soon as possible and corrective measures taken by the Owner. Make corrective measures or modifications to the existing system only if specifically instructed by the Owner in writing.
5. Two-way radio communications shall be verified by testing the two-way communication to and from the outside of the building from a single point approximately at the center of each test grid space or room area. Retesting from a different point inside the same grid space or room area is prohibited if the first point selected fails the test. The initial failure shall be recorded as a failed test grid space or area.
6. Signal strength for a non-failure shall be sufficient to meet the requirements of the applications being utilized by public safety for emergency operations through the coverage area as required by the AHJ.
7. The minimum inbound signal strength shall be sufficient to provide usable voice communications throughout the coverage area as required by the AHJ. The inbound signal level shall be sufficient to provide not less than -95 dBm for analog systems or a Delivered Audio Quality (DAQ) of 3.0 for digital systems or an equivalent Signal-to-Interference-Plus-Noise-Ratio (SINR) applicable to the technology of either analog or digital signals.
8.. The minimum outbound signal strength shall be sufficient to provide usable voice communications throughout the coverage area as required by the AHJ. The outbound signal level shall be sufficient to provide not less than -95 dBm for analog systems or a Delivered Audio Quality (DAQ) of 3.0 for digital systems or an equivalent Signal-to-Interference-Plus-Noise-Ratio (SINR) applicable to the technology of either analog or digital signals.
9. Buildings with existing ERRCES: Verify the following, include the requested information report deficiencies to the Owner as part of the ERRC report.
   a. Verify the existing ERRCES is fully monitored by the building fire alarm system as required by NFPA 1221 and NFPA 72.
   b. If there is an existing remote ERRCES annunciator, verify all annunciators and indicators required by NFPA 1221 are operational and functioning properly.
   c. The gain values of all existing ERRCES amplifiers shall be measured and documented for comparison for future annual testing of the ERRCES.
   d. A spectrum analyzer or other suitable test equipment shall be used to verify spurious oscillations are not being generated by existing signal booster(s).
   e. Verify that the isolation between the donor antenna and all inside antennas is maintained to a minimum of 20dB above system gain.

3.2 SURVEY REPORT SUBMITTALS

A. Submit summary findings and detailed test report data within 14-days of notice to proceed.

B. Buildings not in compliance with the ERRC testing: Indicate areas of the building deficient in ERRC. Provide general recommendations of the necessary equipment and means required to bring the building into full ERRC compliance for Owner review in the summary findings. This specification section is only intended for survey, report, and recommendation information only and is not intended for detailed design, modification, or corrective measures. The report data submittal shall be complete in such that it would be useful to assist in a detailed design of a ERRCES. Submit additional report data as indicated below.

C. Building in compliance with required ERRC: Include a copy of the inspection report to be issued to the AHJ(s) in the format required by the AHJ(s) and submit the report to the AHJ(s) as part of the building permitting process.

D. Report data submittals shall include but are not be limited the following:
   1. Include a copy of survey contractor's AHJ and FCC required licenses to perform the survey.
   2. Where there is an existing ERRCES, include an updated ERRCES technical document and yearly report which the Owner shall keep on file as required by NFPA 1221. Technical documents shall in include but may not be limited to the following information typically provided by the AHJ(s):
      a. Frequencies required by the AHJ(s) for the existing in-building enhancement system (EERCES).
      b. Location and effective radiated power (ERP) of radio sites used by the public safety radio enhancement system (ERRCES).
      c. Maximum propagation delay in microseconds.
      d. List of specifically approved ERRCES components.
      e. Other supporting technical information necessary for the existing system maintenance, or future modifications.
   3. Confirmation that the ERRC for the building that is subject of the report has been determined to meet the minimum coverage requirement as defined by the IBC/IFC, this survey specification section's requirements, and the local AHJ requirements.
   4. Include a scaled drawing of the building with RF measurements of each floor or zone of the building which indicates relative RF field strength for each frequency band of interest. Minimum drawing size 11x17-inch, maximum 30x42-inch.
   5. The drawings shall indicate clearly the areas that have passed or failed based on the more restrictive of the above parameters or those specifically required by the AHJ.
   6. When required by the AHJ, inspection reports by AHJ approved third-party inspector in the format required by the AHJ.

END OF SECTION

SECTION 28 60 00

DISTRICT RADIO COMMUNICATIONS EQUIPMENT

PART 1 - GENERAL

1.1 DESIGN AND CONSTRUCTION REQUIREMENTS

A. Provide a complete and tested Radio Communications System, consisting of an Emergency Radio system and a Radio Repeater system.

B. Contractor Requirements:
   1. Contractor shall provide five years of experience in the installation of radio frequency communications equipment and be a factory authorized dealer and installer for Kenwood equipment. Installation and programming shall be performed by FCC licensed technicians for this type of equipment. The following contractors have been pre-approved by CFISD; other contractors to provide documentation and certification prior to being awarded job.
      a. Northwest Communications 281-890-4724 (Rick Wright, Don Cameron)
      b. Texas Bigfoot Communications 713-462-2929 (Rick Cogar)

C. Submittals (Required):
   1. Product Literature: Complete manufacturer's product literature showing electrical characteristics and connection requirements.
   2. Wiring Diagram: Indicate system wiring diagram showing each device and wiring connection. Indicate partition layout.
   3. Operation and Maintenance Data: Submit manufacturer's standard operating and maintenance instructions.

1.2 WARRANTY

A. One year from date of substantial completion

PART 2 - PRODUCTS AND MATERIALS

A. The Emergency Radio system shall include:
   1. UHF base station radio supporting the district wide emergency frequency.
   2. Mounting antenna in area to provide optimum performance for internal and external communications.
   3. Emergency radio and associated equipment shall be installed in mechanical area with the radio repeater.
   4. Accessory devices and power supply.
   5. Installation of equipment and cabling between antenna and emergency radio.
   6. Tone Remotes shall be installed in principal secretary's office and front reception.
   7. System setup, frequency programming and testing per CFISD Radio Communications Division requirements.
   8. Training shall include demonstration and instructing school staff on operation.
   9. Contractor responsible for cable and termination between IDA 24-66M VOIP Remote w/DeskMic and Network.
   10. Contractor is responsible for cable and termination between Emergency Radio and network.
   11. Equipment:

a. Radio: Kenwood NX-5800-K UHF, 45 watts, 450-520 MHz, 1024 channels/128 zones.
b. Mounting Case: Control Station mounting case for KPS-15 power supply and NX-5800-K radio
c. Power Supply: Kenwood KPS-15 power supply
d. Telephone Style Remove Control: IDA 24-66M VOIP Remote w/DeskMic
e. Remote Termination Panel: IDA 20-28 VOIP Remote Adapter.
f. Antenna: Antenex Model FG4603, 3db gain UHF 460-470 MHz omni antenna with mounting bracket

B. Radio Repeater (Repeater set-up required for ES, MS, HS, Transportation Centers, Stadiums & Multifunction Centers):
1. The Radio Repeater system shall include:
a. Radio repeater supporting the campus wide communication.
b. Mounting antenna in area to provide optimum performance for campus or facility communications.
c. Radio repeater and associated equipment to be installed in mechanical area.
d. System setup, frequency programming and testing per CFISD Radio Communications Division requirements.
e. Contractor responsible for cable and termination between network adapter and network.
f. Contractor is responsible for cable and termination between Kenwood KTI-3 network interface and network.
g. 4 post enclosed rack, duplexer, network adapter, and UPS.
2. Equipment:
a. Repeater: Kenwood NXR-810K UHF, 1-40W, 450-520 MHz. Operational as analog 25 KHz or 12.5 KHz, or digital 12.5 KHz or true 6.25 KHz
b. FCC Licensing: Frequency coordination and acquisition for repeater
c. Antenna: CommScope DB404, 450-470 MHz 3.28/5dB gain
d. Duplexer: 633-6A-2N, UHF Duplexer 450-470 MHz
e. Network Adapter: Kenwood KTI-3 network interface
f. Rack: Tripp Lite SR25UB Smart Rack standard-depth half-height server rack enclosure, doors, and side panels
g. Power Supply: Minuteman ED2000RTXL2U power supply
h. Installation Materials: Connectors, lighting protection, mounting brackets, 5’ antenna mast and all other required installation materials for a complete and operational set-up.

C. Cabling:
1. Provide and install Times LMR-400-LLPL black low loss, plenum rated, indoor/outdoor coax antenna cable with connectors.
2. Provide and install Cat 6 for 24-66M VOIP Remote w/DeskMic in principal secretary’s office and front reception to network. Reference Division 27 10 00.
3. Provide and install Cat 6 for IDA 20-28 VOIP Remote Adapter at the emergency radio to the network. Reference Division 27 10 00.
4. Provide and install Cat 6 cable for Kenwood KTI-3 network interface at the radio repeater to the network. Reference Division 27 10 00.

PART 3 - EXECUTION

A. Demonstration and Training:

1. A written test report from an authorized representative that the system has been 100% tested and is functioning properly shall be submitted prior to training and demonstration.
   a. Contractor shall demonstrate system operation to DVISD security personnel and project manager.
   b. Contractor shall provide one hour of instruction each for two of owner's personnel, to be conducted on site with the manufacturer's representative.

END OF SECTION

SECTION 31 15 00

SITE CLEARING AND EARTHWORK

CONDITIONS OF THE CONTRACT, SUPPLEMENTARY CONDITIONS AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work: This section includes the complete on-site clearing, grubbing, building pad and pavement fill materials, and existing topsoil stockpile requirements, which include, but is not limited to, the following conditions:

01 Placing and compaction of select fill and general fill under improved areas to conform to elevations designated on the drawings.
02 Providing stable and compacted subgrade below buildings, paving, sidewalks and other improvements.
03 Stockpiling of stripped topsoil in an approved location.
04 Excavating for foundations and other improvements.
05 Filling and grading of the area around the building, improvements using previously stripped topsoil, and any additional topsoil that must be purchased and delivered to the site.

C. Related Work:
01 Section 01 45 23 – Inspection and Testing Laboratory Services
02 Section 02 32 00 – Geotechnical Investigation
03 Section 31 22 19 – Finish Grading
04 Section 31 23 33 – Trenching and Backfilling
05 Section 31 32 13.19 – Lime Soil Stabilization
06 Section 32 13 13 – Concrete Paving and flatwork
07 Section 32 84 23 – Underground Sprinklers
08 Section 32 92 13 – Hydro Mulching
09 Section 32 92 23 – Solid Sodding

1.2 SUBMITTALS

A. Comply with section 01 33 00 – Submittal Procedures.

B. Contractor shall provide the name and location of fill pit(s) proposed to be used to furnish fill for the Work for the Lab to collect on-site sample(s).

C. Contractor shall provide a description of select structural fill proposed to be furnished.

D. Sample: provide a minimum of 1 cubic yard sample of proposed structural fill material deposited on site. This sample shall remain on-site through the fill process and be used to visually compare subsequent fill brought to the site.

1.3 REFERENCES

A. Section 02 32 00 – Geotechnical Investigation.

B. American Society for Testing and Materials:
   01 ASTM D698-78, Test for Moisture Unit Weight Relations of Soils and Soil Aggregate.
   02 ASTM D2922, Tests for Density of Soil and Soil Aggregate in place by Nuclear Methods.
   03 ASTM D1557, Moisture Density Relations of Soils and Soil-Aggregate Mixtures.

1.4 QUALITY ASSURANCE

A. Test results shall meet or exceed the standards referenced in Section 01 45 23 – Testing and Inspection Services.
   01 Testing lab services shall be provided by a lab under direct contract with the Owner. Contractor shall be responsible for scheduling all testing services required for excavation and fill.
   02 The Contractor shall be solely responsible for remedy of non-compliant materials and / or test results, including proceeding with subsequent fill installation prior to receiving conclusive test reports from the lab.

B. Proposers shall examine the job site conditions and be informed of all existing site conditions.

C. The Contractor will be required to establish, maintain and be responsible for all reference points, hubs, grades, elevations, lines, and surface measurements. If any discrepancies in the survey information furnished in the documents are found, the Contractor shall promptly notify the Architect and await instructions before proceeding.

1.5 PROJECT SITE CONDITIONS

A. Thoroughly inspect the site and verify unknown utilities and obstacles and any other conditions that will affect the work.
   01 Prior to the start of excavation, coordinate with the Owner to identify and locate known underground utilities and potential obstructions.
   02 If any unknown or uncharted utilities or objects which would be utilities are encountered during excavation, promptly notify the Architect and Owner before proceeding.
   03 Do not proceed until all conflicts are fully resolved.

B. The Contractor shall be responsible for the protection of all existing vegetation, etc. around and within the construction areas noted to remain.

C. The Contractor will be responsible to maintain and control the grading around the construction areas so that the grade is pitched to prevent water from entering the building and/or accumulating in the graded areas throughout the progress of the work.

D. Within the scope of Work, all areas of the site shall be landscaped and / or sodded. The Contractor shall have discretion of scheduling when non-improved areas of the site shall be cleared and grubbed, and prepared for the application of sodding and / or landscaping.

PART 2 - MATERIALS

2.1 TOPSOIL SPOILS

A. Existing topsoil cleared from the site may be used for topsoil and pavement areas in the final grading process provided: the topsoil is free of organics and debris, and it meets the requirements of topsoil as specified.

B. Topsoil intended for re-use shall be stockpiled separately from all other spoil types.

C. Excessive vegetation growth on topsoil stockpiles shall not be allowed. Topsoil for re-use shall be free of deleterious vegetation prior to being placed. Contractor shall use whatever means necessary to prevent contamination of topsoil intended to be re-used.

2.2 TOPSOIL

A. The Contractor shall furnish all additional topsoil that may be required to provide finish elevations and landscaping and sodding requirements.

B. Topsoil fill material shall be free of debris, stumps, roots and stones larger than 3/4 inch diameter. Earth / clay balls shall be broken down to a maximum 1-1/2-inch diameter size.

C. Topsoil must be suitable for rapid grass growth and shall contain a minimal amount of clay.

D. Topsoil shall be a proportional, homogeneous blend of fertile native soil, sand and organic matter / compost specifically blended for rapid grass growth with minimal to no clay.

E. Samples of topsoil shall be submitted to the Architect and Owner for approval prior to installation.

F. Topsoil previously stripped and stockpiled may be used provided it meets all provisions of this paragraph / section.

G. Contractor shall treat existing / previously stripped topsoil to remove all undesirable vegetation, weeds and similar material not conducive to finish grading work and planting of new material / grass.

H. During finish grading, provide a minimum of 2-inches of topsoil over all areas disturbed by construction activities.

2.3 STRUCTURAL / SELECT FILL MATERIAL

A. Refer to the 02 32 00 – Geotechnical Investigation.

B. Structural / select fill shall be lean clay, free from vegetation or other objectionable matter, reasonably free from lumps of the earth, and when tested in accordance with standard testing laboratory procedures shall meet the following requirements:
01 The liquid limit shall not exceed 35.

02 The plasticity index shall not be less than 10, and not more than 20.
03 Sand shall not be blended with clay to form select fill.

C. If the only reasonable source of select fill provided from a source pit is a blend of sand and clay, the Contractor shall be solely responsible for quality control to assure that all material delivered to the project site matches the initial, approved test sample.
01 Blended material that does not conform to the properties of the initial, approved test sample may be rejected at the job site whether installed or not.
02 Coordinate with the source pit as required to ensure quality control is maintained for all select fill delivered to the project site.
03 Select fill blending shall be performed at the pit and not on the site.
04 Adhere to additional recommendations required from Geotech Engineer.

D. Structural / select fill shall be used to construct 100% of the building pad area, including below adjacent paved / concrete areas.

E. Disturbed subgrade below the depth of the building pad shall be filled with structural fill material and compacted in lifts as required to bring the disturbed area / excavation to rough grade elevation.
01 Examples of disturbed subgrade areas includes, but is not limited to: removal of unsuitable subgrade material, removal of existing trees, removal of existing buildings / foundations, removal of existing utilities, removal of tanks or similar foreign objects and materials.
02 The use of on-site material for the building pad fill shall not be allowed.

2.4 NON-STRUCTURAL FILL MATERIAL

A. Refer to the 02 32 00 – Geotechnical Investigation.

B. Non-structural fill shall be silty clay, free of vegetation or other objectionable matter, reasonably free from lumps of the earth, and when tested in accordance with standard testing laboratory procedures shall meet the following requirements:
01 The liquid limit shall not exceed 35.
02 The plasticity index shall not be less than 10, and not more than 20.

C. Non-structural fill material may be used to achieve rough grades at paving / flatwork areas not adjacent to the building and other in unimproved areas.
01 Refer to Section 31 32 13.19 – Lime Soil Stabilization for additional requirements for subgrade at paving and flatwork.

D. Disturbed subgrade below the depth of required subgrade at paving, flatwork, sidewalks, and new site utilities shall be filled with non-structural fill material and compacted in lifts as required to bring the disturbed area / excavation to rough grade elevation.
01 Examples of disturbed subgrade areas includes, but is not limited to: removal of unsuitable subgrade material, removal of existing trees, removal of existing buildings / foundations, removal of existing utilities, removal of tanks or similar foreign objects and materials.
02 The use of on-site material may be used for topsoil and pavement areas in the final grading process provided: the topsoil is free of organics and debris, and it meets the requirements of topsoil as specified in this section.

PART 3 - EXECUTION

3.1 CLEARING AND GRUBBING

A. Site Conditions:
   01 Prior to start of work; coordinate with Architect and Owner for locations of proposed stockpiles of spoils material.
   02 Where site areas are identified to remain primarily or fully in their state, coordinate with Architect on site to specifically define the limits of such areas. Such areas shall be clearly marked and contractor shall use all means necessary to eliminate detrimental traffic in the area, prevent damage and preserve the area.
   03 Where tree areas are indicated to remain, contractor shall carefully remove all underbrush and ground vegetation for grading and drainage. Coordinate with Architect for specific work required.
   04 Excavate all work in an orderly and careful manner, with due consideration for any and all surrounding areas, plants or structures which are to remain.
   05 Periodically water as required to allay dust and dirt.
   06 Protect any adjacent property and improvements from damage, and repair and / or replace any portions damaged through this operation.

B. Clear and grub the premises of all ground vegetation, underbrush, surface material, growth and the like, as required to remove any obstruction to the work indicated on the Drawings.

C. Except for site areas indicated to remain, grub the entire ground surfaces down to 6 inches minimum below present grades.

D. Remove any stones, stumps and roots larger than 3/4 inch in diameter to a depth not less than 18-inches below the original grade level.

E. Remove any stones, stumps and roots larger than ¼-inch in diameter to a depth not less than 18-inches below the original grade level in the play/athletic field areas.

F. Unless indicated to remain, remove all trees, shrubs, underbrush and vegetation.
   01 When encountered within the building pad area, remove main roots and stump roots in its entirety.
   02 When encountered within the paving areas, tree stumps should be grubbed to a minimum depth of 3-feet below the original grade level.

G. After removal of obstruction, backfill and compact depressions / excavations as described in part 3.4.A.

H. Except for grass, all vegetation, underbrush and trees shall be removed from the site and / or disposed of in a proper manner. Stockpiling of vegetation shall not be permitted beyond a temporary basis.

I. All excavated materials and spoils not intended for re-use on the site shall be removed from the site.

J. Vegetation / plants / trees indicated to remain which are damaged, removed, killed, or constricted from normal growth patterns due to Contractor activities shall

be replaced with a comparable item, or the full replacement amount credited to the Owner.

K. Where trees are indicated to remain, stop topsoil stripping at drip line to prevent main root system damage.
   01 In all construction areas, provide approved barricades around the drip lines of trees and shrubs, to protect them from construction operations until Substantial Completion, or until barricade removal is directed by Architect.
   02 Replace damaged trees and vegetation designated to remain with vegetation of equal kind and size, or the full replacement amount credited to the Owner. Follow supplier's recommended procedures for planting necessary replacement vegetation, and per direction of the Architect.

3.2 BUILDING PAD PREPARATION

A. Excavate 100% of the building pad plus 5-feet minimum beyond the building foundation, including below adjacent paved / concrete areas, including the following minimum amounts and thicknesses:
   01 Building pad: 24-inches.
   02 Service Yard: Same as building pad.
   03 Sidewalks / concrete flatwork directly adjacent to the building: 12-inches if outside the 5'-0" limit.

B. Excavate to elevations and dimensions indicated and required, plus sufficient space to permit erection of forms, and select fill.

C. Footing: Floor and wall excavations shall be finished level. Protect bottom of excavation from frost. Shore and brace excavations, protect all slopes and earth banks, and provide sheet piling, if necessary, to prevent cave-in. Remove shoring and piling before backfilling is completed, but not until permanent supports are in place.

D. Grading: Contractor shall control the grading around building so that ground is pitched to prevent water from running into the excavated areas of building or damaging other structures. Furnish pumping required to keep excavated spaces clear of water during construction. If a foundation excavation must remain empty through a shut-down period, cover with boards and building paper, and clean out immediately prior to placing concrete. If any subgrade should be damaged due to flooding, damaged area shall be removed and filled with select fill. Placement and compaction of select fill shall meet the requirements for placing and compacting of select fill.

3.3 PAVING PREPARATION

A. Excavate 100% of the paving area plus 5-feet minimum beyond the paved / concrete areas, including the following minimum amounts and thicknesses:
   01 Remove 24-inches minimum of existing subgrade in preparation for installation of select fill for paving.
   02 The top 6 inches of the finished subgrade soils directly beneath the pavements shall be chemically treated with a lime or mixture of lime-flyash.

B. Grading: Contractor shall control the grading around the paving areas so that ground is pitched to prevent water from running into the excavated areas. If any subgrade should be damaged due to flooding, damaged area shall be removed and filled non-structural fill. Placement and compaction of non-structural fill shall meet the requirements for placing and compacting of non-structural fill.

3.4 PREPARATION FOR BUILDING AND PAVING SUBGRADE

A. After the topsoil has been removed and stockpiled in an approved location and the subgrade has been grubbed and cut to proper elevation, scarify and compact the top 6-inches minimum of existing subgrade to a dry density not less than 95%, Standard Proctor Density– (ASTM D 698). Should the cut elevation be below the grubbing depth, scarify and compact the top with 6-inches of new subgrade to a dry density not less than 95%, Standard Proctor Density.

B. In areas where paving subgrade is on select fill, subgrade preparation may be performed as specified in part 3.5-C.

C. Unstable Areas: Proofroll the entire area with a loaded rubber tire 10-yard dump truck. If unstable areas are encountered, over-excavate and remove the unstable material and replace with the specified type of select fill. Placement and compaction of select fill in unstable areas shall meet the requirements for placing and compacting of select fill.

D. The subgrade shall be compacted using a sheep's foot roller or other approved methods which will assure bonding of layers of fill material.

E. Contractor shall be responsible for any damage caused to existing structure because of over-excavation or excavations left open during inclement weather.

F. Should the subgrade, due to any reason or cause, lose the required stability, density, or finish before the pavement structure is placed, it shall be re-compacted and refinished at the sole expense of the Contractor.

G. Preparation of Subgrade in Inclement Weather: The Contractor may encounter difficulty in densifying/preparing the surficial soil depending on weather conditions. If inclement weather causes the surficial soils to become unsuitably wet, the Contractor will have one of the following options:

01 Adequately dry the surficial soils by discing these materials.

02 Dry the surficial soils by blending hydrated lime or fly ash with the unsuitably wet soils. Refer to Section 31 32 13.19 – Lime Soil Stabilization.

03 Remove the unsuitably wet soils and replace the wet soil with select fill having acceptable moisture content.

This option will be entirely up to the Contractor. No extra will be paid by the Owner.

3.5 FILL MATERIAL PLACEMENT

A. Use under all building slabs, paving, sidewalks or other improved areas requiring fill, and to replace unstable subgrade.

B. Provide and place select fill when existing subgrade is in satisfactory condition, as determined by the testing laboratory.

C. Place under laboratory control, in layers of not more than 8-inches in loose thickness, at moisture contents at or above optimum, and compacted to densities of at least 95% of Standard Proctor Density, as determined by ASTM D698 test procedure and within 4% of optimum moisture content.

D. Compaction of the select fill shall be accomplished by means of sheep's foot rollers or other approved methods which will assure bonding of layers of fill material.

3.6 GENERAL TOPSOIL MATERIAL PLACEMENT

A. During construction, perform rough grading as required to provide positive drainage of the site.

B. Place general fill and rough grading in unimproved areas.

C. Rough grade to achieve elevations indicated allowing for installation of required top soil, landscaping and sodding.

D. Compact rough graded areas to densities of at least 95% of Standard Proctor Density, as determined by ASTM D 698 test procedure and within 2% of optimum moisture content.

E. Re-grade and re-compact any areas that do not retain grade prior to placement of topsoil.

F. Refer to Section 31 22 19 - Finish Grading.

END OF SECTION

SECTION 31 22 19

FINISH GRADING

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Fine grading to meet required finish elevations indicated on the Drawings; distribution of top-soil over the site; and coordination with installation of sodding and landscaping.
   02 Disc the existing and / or filled subgrade to a depth of 6 inches using a landscape scarifier.
   03 Remove all roots, rocks, stumps, trash and all construction debris prior to rough grading.
   04 Following the removal of all foreign materials, and when the rough grading is completed, provide and place previously stripped material or silty or sandy clay material in the amounts required to bring the rough grade to within 2 inches of finish grade.
   05 Assure bonding of layers of fill material by discing in compliance with the specifications.
   06 Spread 2 inches of topsoil over graded areas after rough grading has been completed and approved.
      a. Topsoil previously stripped and stockpiled may be used, provided it meets all requirements for topsoil (Refer to Section 31 15 00 – Site Clearing and Earthwork).
      b. The Contractor shall furnish all additional topsoil that may be required to provide finish elevations.
      c. Existing topsoil and additional topsoil fill material shall be free of debris, stumps, roots and stones larger than 3/4 inch diameter.
      d. Samples of topsoil shall be submitted to the Architect and Owner for approval prior to installation.
      e. Topsoil must be suitable for rapid grass growth with little to no clay.
   07 Final and fine grading shall be done using a tractor pulled landscape rake and hand raking, removing all debris immediately prior to landscaping / hydro-mulching. The final graded ground surface shall be relatively smooth, free of organic material and all construction material debris; and in suitable condition to commence landscaping work.

C. Related Work:
   01 Section 02 32 00 – Geotechnical Investigation
   02 Section 31 15 00 – Site Clearing and Earthwork
   03 Section 32 92 13 – Hydro-mulching
   04 Section 32 92 23 – Sodding

1.2 PROJECT CONDITIONS

A. The Contractor will be responsible to maintain and control the grading around the building so that the grade is sloped to prevent water from ponding adjacent to or entering the building and / or accumulating in the graded areas throughout the progress of the Work.

B. Utilities and other remaining obstacles shall be properly identified prior to commencement of the final grading.

1.3 QUALITY ASSURANCE

A. Testing Laboratory Services. Test results shall meet or exceed the standards.

B. American Society for Testing and Materials:
   01 ASTM D698-78, Test for Moisture Unit Weight Relations of Soils and Soil Aggregate.
   02 ASTM D2922, Tests for Density of Soil and Soil Aggregate in place by Nuclear Methods.
   03 ASTM D1557, Moisture Density Relations of Soils and Soil-Aggregate Mixtures.

PART 2- PRODUCTS

2.1 MATERIALS

A. Refer to Section 31 15 00 – Site Clearing and Earthwork for description of fill and topsoil materials.

PART 3- EXECUTION

3.1 FIELD QUALITY CONTROL

A. Preparation:
   01 Upon completion of grading and prior to placement of topsoil, Contractor shall thoroughly remove all construction debris, weeds, foreign plants, rocks 3/4" diameter or larger, and other non-soil materials.
   02 Remove by hand or hand rake if / where necessary.

B. Inspection:
   01 The Contractor, prior to placing any topsoil, shall contact the Architect and Owner when the grading is complete and all foreign materials have been removed, to review these areas for compliance with the contract requirements.
   02 Prior to placement of any topsoil, the Architect and Owner will review with the Contractor the areas designated complete and ready for final grading.
   03 The topsoil installation shall proceed immediately when the designated areas have been reviewed and determined acceptable.
   04 The Contractor shall contact the Architect and Owner to review the areas when the topsoil has been placed, debris removed, and all final grading has been completed.

05 This review shall occur prior to any sodding, seeding, hydro-mulching, and/or other landscaping operations proceeding within these designated areas.

06 Any construction materials, discovered or uncovered during and / or after the landscaping / sodding operations, shall be the responsibility of the Contractor to remove and replace each area to its finished condition.

3.2 INSTALLATION

A. Work under this Section consists generally of the following operations:

01 Disc the existing and / or filled subgrade to a depth of 6 inches using a landscape scarifier.

02 Place topsoil material in the amounts required to bring the rough grade to within 2” of finish sodded grade; and within 1” of areas to receive hydro-mulch.

03 Assure bonding of layers of fill material by discing in compliance with the specifications.

04 Final and fine grading shall be done using a tractor pulled landscape rake and hand raking, removing all debris immediately prior to landscaping / sodding / hydro-mulching. The final graded ground surface shall be relatively smooth, free of organic material and all construction material debris; and in suitable condition to commence landscaping work.

B. Solid Sodded Areas:

01 Grading at areas to receive solid sodding shall account for nominal thickness of root base / soil included in the solid sod blankets.

02 Grading at solid sodded area at building perimeter shall result in top of grass blanket soil flush with the bottom of the brick ledge, sidewalks and flatwork; unless shown otherwise on the Drawings.

03 Sodding shall not impede the drainage of water off or over sidewalks and flatwork.

04 Where solid sodding adjoins areas of hydro-mulched sodding, grade area to provide a level transition from one sodded area to the other after grass / hydro-mulch is established and fully rooted.

3.3 PROTECTION AND MAINTENANCE

A. The Contractor shall be responsible for the protecting and maintaining completed finish grading prior to the start of sodding and landscape work by the Owner.

B. Damage caused by surface run-off, construction vehicular traffic, use of equipment or other Contractor controlled activities shall immediately be repaired and restored to originally accepted state.

END OF SECTION

SECTION 31 23 33

TRENCHING AND BACKFILLING

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Include the following work in addition to items normally part of this Section:
      a. Coordinate, excavate and backfill all trenching required for underground service raceways, duct banks, storm sewer and any other utility lines.
      b. Provide necessary safety systems to comply with local and State laws.

C. Related Work:
   01 Section 02 32 00 – Geotechnical Investigation
   02 Section 31 15 00 – Site Clearing and Earthwork
   03 Section 31 22 19 – Finish Grading
   04 Section 31 32 13.19 – Lime Soil Stabilization

D. Unknown Utilities and Obstacles:
   01 If any unknown and uncharted utilities are encountered during excavation, promptly notify the Architect and wait for his instructions before proceeding.
   02 If such unknown utilities are encountered and Work is continued without contacting the Architect for instructions, and damage is caused to said utilities, repair such damage to the satisfaction of the Owner at no additional cost to the Owner.
   03 If any unforeseen major obstacle is encountered in excavation, the Owner will have a survey made to determine the course of action which will relieve the Contractor of undue expense.

1.2 SUBMITTALS

A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete Shop Drawings consisting of trench locations and types of backfill proposed to be used at each location.

1.3 REFERENCES

A. ASTM International:
   01 ASTM C40 – Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.
   02 ASTM C123 – Standard Test Method for Lightweight Particles in Aggregate.
   03 ASTM C142 – Standard Test Method for Clay Lumps and Friable Particles in Aggregates.
   04 ASTM C150 – Standard Specification for Portland Cement.
   05 ASTM D1140 - Standard Test Methods for Determining the Amount of Material Finer than 75-µm (No. 200) Sieve in Soils by Washing.
   06 ASTM D2216 - Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
   07 ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
   08 ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

PART 2 – MATERIALS

2.1 MANUFACTURERS

A. Specification of bentonite materials is based on Sodium Bentonite as manufactured by Texas Sodium Bentonite Inc.

B. Products from other manufacturers will be considered provided the product meets or exceeds specified properties and requirements.

2.2 STRUCTURAL FILL MATERIAL

A. Structural fill shall be lean clay, free from vegetation or other objectionable matter, reasonably free from lumps of the earth, and when tested in accordance with standard testing laboratory procedures shall meet the following requirements:
   01 The liquid limit shall not exceed 35.
   02 The plasticity index shall not be less than 10, nor more than 20.
   03 Sand shall not be blended with clay to form select fill.

B. Structural fill shall be used to construct 100% of the building pad, including trench backfill within the limits of the building pad depth.
   01 The building pad shall extend a minimum of 5’-0” beyond the footprint of the building.

2.3 NON-STRUCTURAL FILL MATERIAL

A. Non-structural fill shall be silty clay, free from vegetation or other objectionable matter, reasonably free from lumps of the earth, and when tested in accordance with standard testing laboratory procedures shall meet the following requirements:
   01 The liquid limit shall not exceed 35.
   02 The plasticity index shall not be less than 10, and not more than 20.

B. Based on specimens taken during the soil's investigation, on-site material below top soil stripping should be suitable for use as non-structural fill; subject to lime stabilization at paved areas.

2.4 CEMENT STABILIZED SAND

A. Cement: shall consist of Type I, II or V Portland cement conforming to ASTM C-150.

B. Sand: Clean, durable sand meeting the following requirements:
   01 Deleterious Material – Clay: ASTM C142 – less than 0.5%.
   02 Deleterious Material – Lightweight Pieces: ASTM C123 – less than 5%.
   03 Deleterious Material – Organic Impurities: ASTM C40 – shall not show a color darker than the standard color.
   04 Plasticity Index: ASTM D4318 – 6 or less.
   05 Gradation Requirements: 100% passing 3/8" sieve; less than 5% passing a no. 200 sieve; minimum sand equivalent of 30.

C. Water: Potable; and free of oils, acids, alkalis, organic matter and other deleterious materials.

D. Sand-Cement Mixture: shall consist of the proper percentage of cement per cubic yard or per ton of sand with sufficient water to hydrate the cement. A minimum of 1.5 sack of cement per ton of sand shall be required.

2.5 SODIUM BENTONITE

A. Sodium bentonite shall be a fine sand texture, with minimum 75% montmorillonite content, manufactured specifically for the purpose of preventing the passage of water under normal ground hydrostatic conditions.

B. Physical Properties: bentonite material shall generally meet the following properties:

01	Unified Soil Classification	CH	ASTM D2487
02	Moisture Content	6.8 maximum	ASTM D2216
03	Percent Passing no. 200 Sieve	98% minimum	ASTM D1140
04	Liquid Limit	365	ASTM D4318
05	Plastic Limit	26	ASTM D4318
06	Plasticity Index	339	ASTM D4318

PART 3 - EXECUTION

3.1 TRENCHING

A. Excavate trenches to required depths, slope and grade.

B. Remove mud and other unstable soil encountered in trench bottom to firm bearing and backfill with sand to proper grade and compact to uniform firm support for the bottom of the raceways and duct banks.

C. In the event rock is encountered, excavate 6 inches below required depth, and backfill to required depth with sand to proper grade and compact to uniform firm support. (95% maximum density at paved areas).

D. Make full and complete repair of streets, roadways, and walks which have been cut with materials of like nature to those cut away.

E. Exercise care for the safety of employees, materials and equipment in or near trenches or other excavations. City of Houston trench shoring details are available from the City of Houston Public Works Department, and by inference are included in these specifications for trenching requirements.

F. Remove all trenching spoils material from the site.

3.2 BACKFILLING

A. Refer to Section 01 31 29 - Notification of Architect Requirements.

B. Do not backfill trenches until all required tests have been made on the utility lines installed.

C. Bedding for pipes shall be as required / described in the Plumbing and / Civil Drawings and Specifications.

D. Backfill trenches outside limits of concrete work with select fill material in maximum 8-inch layers. Compact each layer of select fill to 95% ASTM Density, D-698.

E. Backfill all trenches under pavement or concrete flatwork with cement stabilized sand in maximum 8-inch layers to within 1 foot of pavement subgrade surface. Complete the backfill with structural fill material. Compact each layer to 95% ASTM Density, D-698.

F. Backfill all trenches under the building slab with structural fill material in maximum 8-inch layers. Compact each layer of cement stabilized sand to 95% ASTM Density, D-698.

G. Compaction of backfill at trenches shall be performed only with methods and / or equipment specifically designed for the purpose.

H. Perform all testing as recommended by the testing laboratory on each lift of backfill installation.

3.3 SODIUM BENTONITE TRENCH DAMS AT BUILDING

A. It is a requirement of this provision to prevent the migration of water underneath the building foundation through trenches which pass through the building perimeter.

B. The bentonite trench dams must be installed across the entire trench, including below the pipe, at the foundation wall.

C. Required Locations: At all trenches 8” in width or wider which cross the building foundation perimeter grade beam (outside to inside the building footprint), provide a trench dam comprised of sodium bentonite. No additives permitted.

D. Trench dams shall be between 12” and 24” wide directly adjacent to the foundation wall / grade beam outside the building foundation. The dam shall

completely fill the trench, encompassing the pipe, to within 4” of finish grade, or to the top of grade below exterior concrete surfaces.

E. Applicable trenches shall include but are not limited to:
   01 Water service piping.
   02 Sanitary sewer piping.
   03 Electrical (and similar) service conduits / duct banks.
   04 Storm sewer piping.

3.4 COORDINATION

A. It is critical for the Building Plumbing Contractor and the Site Utility Contractor (if they are not one in the same) to coordinate points of interface connection.

B. Design is based on flow lines and invert elevations as indicated on the Civil and Plumbing Drawings.

C. The Contractors shall use whatever means are necessary to coordinate accurate interface from the building systems to the site systems. Excessive flexible connections or other connections which adversely affect the storm / sanitary sewer flow as designed shall not be allowed.

END OF SECTION

SECTION 31 31 16

TERMITE CONTROL

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide termite control treatment below foundation on grade prior to placement of vapor membrane. Foundation to include grade beams and slab-on-grade.
   02 Extend treatment to 5'-0" outside of building perimeter.

C. Related Work:
   01 Section 31 20 00 – Earth Moving

1.2 SUBMITTALS

A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
   01 Manufacturer's product data for all products proposed to be furnished, including copy of EPA registration and MSDS sheets.

C. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Include application strengths / rates for all areas to be treated (i.e. building pad directly below slab, grade beams, etc.).
   02 Submit actual quantities (gallons) to be furnished for each application.

D. Affidavit: Submit a signed affidavit immediately following application of termite treatment, attesting the specification compliance of the chemicals, their proportions, and application.

E. For warranties longer than one (1) year, submit a sample of the warranty proposed to be furnished.

1.3 QUALITY ASSURANCE

A. Comply with all applicable governmental standards for use and storage of these materials. Use these chemicals for this Work only. Unauthorized use of these chemicals is strictly forbidden.

B. Subcontractors Qualifications:
   01 Applicator shall be bonded to perform this type of Work.
   02 Where local licensing is available or required, applicator shall be licensed to perform this type of Work.

1.4 WARRANTY

A. Warranty the Work specified herein for five (5) years against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials or workmanship.
   01 The warranty shall include a one (1) year damage guarantee for repair / replacement of any damaged building materials caused by termites.
   02 The warranty shall include an additional four (4) year service guarantee against termite activity within the affected area.

PART 2 - PRODUCTS

2.1 PRODUCT OVERVIEW

A. Poison Diluent: Portable water.

B. Treatment Chemical / Products:
   01 Termidor SC (9.1% active ingredient Fipronil)
   02 Taurus SC

C. Other equal product containing the specified chemical(s) as approved by the Architect.

D. Provide color additive for a visual indication of areas treated.

E. Only one product shall be used for all termite control treatment.

F. Application to be by pest control power pump sprayer, manual backpack-type sprayers are not allowed.

PART 3 - EXECUTION

3.1 APPLICATION

A. Quantities of Working Solution: Shall be as recommended by the manufacturer for this specific application.

B. Procedures:
   01 Notify the supervising authority before commencing Work.
   02 Do not apply poison to soils that are excessively wet.
   03 Apply solution immediately prior to placing vapor barrier or waterproofing membrane.
   04 In the event of rain prior to placement of concrete, re-apply solution in accordance with manufacturer’s specifications and recommendations.

C. Upon completion of the entire slab-on-grade area, furnish the required affidavit and warranty.

END OF SECTION

SECTION 31 32 13.19

LIME SOIL STABILIZATION

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work: Provide soil stabilization below and to 36” beyond the limits of the following areas:
   01 Concrete paving parking areas, driveways and approaches
   02 Mechanical and kitchen service yards.
   03 Concrete flatwork areas, excluding sidewalks.

C. Related Work:
   01 Section 02 32 00 – Geotechnical Investigation.
   02 Section 03 30 00 – Cast-In-Place Concrete.
   03 Section 31 15 00 – Site Clearing and Earthwork.
   04 Section 32 13 13 – Concrete Paving and Flatwork.

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer’s literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Mix Design: Provide proposed mix designs to achieve required percentage when mixed with substrate fill material.

D. Installation Instructions: Submit manufacturer’s complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.

1.3 REFERENCES

A. ASTM International:
   01 ASTM C911 - Standard Specification for Quicklime, Hydrated Lime, and Limestone for Selected Chemical and Industrial Uses.
   02 ASTM C977 - Standard Specification for Quicklime and Hydrated Lime for Soil Stabilization
   03 ASTM D698 - Tests for Moisture-Unit Weight Relations of Soils and Soil Aggregate.

B. Texas Highway Department Publications: Standard Specifications for Construction of Highways, Streets and Bridges
   01 Item 260 – Lime Treatment (Road Mixed)
   02 Item 263 – Lime Stabilization (plant Mixed)

C. Texas Department of Transportation Departmental Material Specifications (DMS), latest edition:
   01 DMS 6350 – Lime and Lime Slurry.

1.4 QUALITY ASSURANCE

A. Codes and Standards: Perform earthwork complying with requirements of authorities having jurisdiction.

B. Testing and Inspection Service: Contractor responsible to coordinate with the testing agency prior to start of work requiring testing so as to minimize unnecessary cost or delays to the project.

C. Testing:
   01 Owner will retain and pay a qualified Materials Testing Laboratory to take all field samples and do all laboratory testing necessary to verify compliance of the work to these Specifications or as required by City or other regulatory agencies.
   02 All tests shall be performed by the Materials Testing Laboratory Materials Testing Laboratory in accordance with ASTM D 698, D1556, or other test method selected by Geotechnical Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Lime Slurry:
   01 Lime slurry for use in treating the subgrade shall conform to the chemical and physical requirements listed in Tables 1 and 2 of TxDOT Departmental Material Specification (DMS) 6350 for Commercial Lime Slurry.
   02 Lime Slurry may be prepared at the job site or other Owner approved location by using Hydrated Lime or Quicklime as specified by chemical and physical requirements in Tables 1 and 2 of TxDOT Departmental Material specifications (DMS) 6350.

B. Water:
   01 Water used for mixing or curing shall be reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable matter or other substances injurious to the finished product.
   02 Water sources other than the local municipal domestic water supply must be approved by the Civil Engineer.

PART 3 - EXECUTION

3.1 GENERAL

A. After preparatory work specified under 31 20 00 – Earth Moving has been satisfactorily completed and approved by the Testing Laboratory, a minimum of 6 inches of earth material which occurs at the top of the existing subgrade

beneath all scope areas listed in paragraph 1.1 shall be scarified, and a stabilized subgrade be installed.

01 Extend stabilization a minimum of 5 feet beyond the edge of the required areas.

B. Construction methods shall conform to the applicable specifications of the TxDOT specifications, Item 260, Lime Treatment.

C. Lime shall be spread only on that area where the first mixing operations can be completed during the same working day.

3.2 APPLICATION

A. The percent of lime to the dry weight of the soil shall be a minimum of six percent (6%). Refer to the Project Geotechnical Report.

B. The lime shall be mixed with water in trucks with approved distributors and applied as a thin water suspension or slurry.

C. The distribution of lime shall be uniformly placed in such quantity that all soil to be treated receives the minimum percentage of lime and successive passes made until the proper moisture and lime content is obtained.

D. The distributor truck shall be equipped with an agitator which will keep the lime and water in uniform mixture unless the prescribed consistency can be otherwise maintained. If an agitator is not used, a standby pump shall be available at the site for agitating the lime and water in case of delays in dispersing the slurry.

E. Liquid lime soil stabilization products and materials shall be used when residences are within one-half mile in any direction from the facility site.

F. No dry-type lime soil stabilization shall take place when the building or campus is occupied by students during the school day.

3.3 MIXING

A. The material and lime shall be thoroughly mixed by approved road mixers until a homogeneous, friable mixture of material and lime is obtained, free from all clods or lumps.

B. Immediately after the "first mixing" operation, the mixture shall be brought to the proper moisture content and sealed with a light pneumatic rubber tire roller and left to cure for 1 to 4 days, as directed by the Owner. If rework is required to obtain compaction after 72 hours of the last mixing, add 25% of the specified rate of lime.

C. After curing time the material shall be uniformly mixed. All clods shall be reduced in size by raking, blading, discing, harrowing, scarifying or other approved method.

3.4 COMPACTION

A. Compaction of the mixture shall begin immediately after final mixing and in no case later than 3 calendar days after final mixing.

B. The moisture content at time of compaction shall be at optimum to four percent (4%) above optimum.

C. The mixture when used as pavement subgrade shall be compacted by sheepsfoot rollers or 25 ton pneumatic self-propelled rollers until a minimum density of 95% of Standard Maximum Density (ASTM D-698-07e1) is obtained.

END OF SECTION

SECTION 32 13 13

CONCRETE PAVING AND FLATWORK

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide all exterior concrete paving, as indicated on the Drawings; including, but not necessarily limited to:
      a. Concrete parking areas, driveways and curbs.
      b. Concrete sidewalks.
      c. Service yards.
      d. Activity and sports areas.
      e. Ramps and steps.
      f. Site light bases.
      g. Other concrete flatwork as indicated on the Drawings.

C. Related Work:
   01 Section 01 45 29 – Inspection Testing Lab
   02 Section 03 30 00 – Cast-In-Place Concrete
   03 Section 07 92 00 – Joint Sealants
   04 Section 31 15 00 – Site Clearing and Earthwork
   05 Section 31 22 19 – Finish Grading
   06 Section 31 32 13.19 – Lime Soil Stabilization

1.2 SUBMITTALS

A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Proposed mix designs, including adequate historical documentation to substantiate performance and strengths.

D. Shop Drawings:
   01 Shop Drawings for all reinforcing steel. Show bending diagrams, splicing and laps of rods, shapes, dimension and details of bar reinforcement and accessories.
   02 Shop Drawings showing location of all proposed construction and control joints, keying / keyways, water stops, openings, depressions, trenches, sleeves, inserts, and other items affecting reinforcement and placement of concrete.
   03 Placement sequence schedule (may be combined with Item 02).

04 Unless shown on the Site Plan, submit proposed layout for all expansion joints in paving, flatwork and sidewalks.

E. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
02 Generic details that do not depict actual conditions shall not be acceptable.

F. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
01 Include recommended cleaning products and instructions for use.
02 Where applicable, provide recommended maintenance schedules and procedures.

G. Samples of Proposed Materials: Provide two (2) actual samples of the following products:
01 Plastic chair rebar supports.
02 Slab membrane(s) and tape(s); 8" x 10" minimum membrane and 12" minimum tape.
03 Water stops; minimum 6" length.
04 Stains: full range of manufacturer's available colors selections for colored concrete.
a. May begin with digital images.
b. Architect shall select up to four (4) colors for Contractor to submit actual samples of.

H. Tests and Certifications:
01 Before starting any work under this section, make all required arrangements with the testing agency. The testing laboratory shall test and furnish certified reports on proposed cements, aggregates, mixing water and admixtures.
02 Submit proposed design mixes for each type of concrete using previously tested and approved materials.
03 Furnish certified reports of each proposed mix for each type of concrete.
04 Proportion mixes by laboratory trial batch or field experience methods, using materials to be employed in the work for each class of concrete required, and report to the Architect.
05 Refer to Section 01 45 23 – Testing and Inspection Services for on-site procedures and testing requirements.
06 Furnish ready mix delivery tickets.

1.3 REFERENCES

A. Refer to Section 03 30 00 – Cast-In-Place Concrete.

B. The current editions of the following documents govern the work, except where more restrictive items are specified.

01 Standard Specifications for Construction of Highways, Streets, and Bridges by Texas Highway Department.
02 Texas Department of Transportation.

PART 2 - PRODUCTS

2.1 PAVING / CONCRETE MATERIALS

A. Compacted Sub-Base: as specified in Section 31 15 00 – Site Clearing and Earthwork and 31 32 13.19 – Lime Soil Stabilization.

B. Concrete Material:
01 Refer to Section 03 30 00 – Cast-In-Place Concrete for general provisions of concrete material.
02 Aggregate shall be limestone at paving.
03 All concrete used for paving shall have a minimum compressive strength of 3000 PSI unless a higher strength is identified in the soil investigation / Geotechnical Report.
04 All concrete used for sidewalks and concrete flatwork shall have a minimum compressive strength of 3000 PSI.

C. Forms: steel, wood, or other suitable material(s) of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal.
01 Use straight forms free from distortion and defects. Use flexible spring steel forms or laminated boards to conform to radius bends as required.
02 Form Coating: a non-staining form release agent that will not discolor or deface surface of concrete.

D. Reinforcing Bars: deformed billet steel bars.
01 Comply with provisions of Section 03 30 00 – Cast-In-Place Concrete.

E. Rebar Chairs and Spacers:
01 OCM, Inc. – “Plastic Cradle Chair”.
02 Aztec “Castle Chair”.
03 Heavy-duty plastic-type sized to support all slab steel at proper height.
04 Use type with sand cushion pads where concrete is on grade.

F. Construction Joints:
01 Metal Keyway: tongue and groove joint, 5" wide, 24 gauge, galvanized with 18-gauge stake pins; Heckman Building Products, Model 95-50; or approved equal.

G. Flexible Expansion Joints:
01 Expansion Joints - Flexible: Asphalt impregnated fiberboard, ½” wide in sizes required. All joints shall be sealed continuous with an approved paving joint sealer.
02 To be installed continuously at all flatwork-to-building conditions.
03 Cap sealant: Comply with Fed. Spec. TT-S-00227E “Two Component”, 100% Urethane (light grey). All joints shall be sealed continuous.

H. Load Transfer Units:

01 Sidewalks: 3/4 inch thick redwood form with 1/4 inch deep removable top strip, 1/2” x 10" steel reinforcing bars at 15 inches O.C. +/- with bond breaker sleeve on one side.
02 Paving: 3/4 inch thick redwood form with 1/4 inch deep removable top strip, 3/4” x 12" steel reinforcing bars at 12 inches O.C. +/- with bond breaker sleeve on one side.
03 Provide custom size as required for full depth of paving and sealant depth as required by sealant manufacturer.

I. Decorative Wood Joints: Where indicated in the Drawing, provide construction heart grade redwood joints conforming to AASHO-M-90. Provide sizes indicated on the Drawings. Do not install adjacent to curbs.

J. Control Joints: Tooled Joint:
01 Scored Joints: Tool edged joints, 3/16” to 1/4" wide; depth shall be 1/4 the thickness of the concrete in depth. Score as soon as practical after initial concrete placement.
02 Saw-Cut Joints: Machine cut saw joints shall be 1/4 the thickness of the concrete paving. Installation with hand held saw is not permitted. Saw cut joints as soon as practical (4 to 8 hours after placement) for cut edge to not chip or spall.
03 Zip Joints: Not permitted.

K. Concrete Materials: Comply with the requirements of Section 03 30 00 – Cast-In-Place Concrete for concrete materials, admixtures, curing materials, and others as required.

L. Paving Joint Sealant:
01 Self-leveling polyurethane sealant specifically formulated for use in pavement / concrete expansion joints.
02 Refer to section 07 92 00 for product information.

2.2 COLORED AND IMPRINTED CONCRETE

A. Design of imprinted colored concrete is based on products / systems manufactured by Bomanite.

B. Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this section, provide all proposed products meet or exceed the specified requirements.
01 Increte Systems / Euchlid.

C. Integral Coloring Admixture: Integral Color by Bomanite Corporation, synthetic oxide pigment, meeting ASTM C979 and C494; or approved equal. Color as selected by Architect from full range of manufacturer’s colors.
01 Provide at all areas indicated on the Drawings to be integral colored concrete.

D. Colored Concrete: Equal to Bomanite Color Hardener. Color as selected by Architect from full range of manufacturer’s colors.
01 Provide at all ramps as required by Americans with Disabilities Act and Texas Department of Licensing and Registration “Texas Accessibility Standards”.
02 Provide at all areas designated “Imprinted Concrete”.

E. Release Agent: As recommended by the manufacturer for the specific installation.

F. Curing Agent: Equal to Bomanite “Clear Cure”.

G. Sealing and Finishing Coat: Equal to Bomanite “Hydroblock”.

2.3 TACTILE WARNING SURFACE MATERIALS

A. Composition: Composite shell cast-in-place tactile warning surface units shall be manufactured using a matte finish exterior grade homogeneous (uniform color throughout thickness of product) glass and carbon reinforced polyester based SMC composite material.
   01 Truncated domes must contain fiberglass reinforcement within the truncated dome for superior structural integrity and impact resistance.
   02 A matte finish will be required on the tactile warning surface for superior slip resistance performance superior to that offered by a gloss finish.
   03 Use of tactile warning surface products employing coatings or featuring layers of material with differing composition, performance, or color properties is expressly prohibited under this Section.

B. Color: Brick Red conforming to Federal Standard 595B Table IV, Color No. 30109. Color shall be homogeneous throughout the composite shell cast-in-place tactile warning surface unit.

C. Domes: Square grid pattern of raised truncated domes of 0.2 inches nominal height, base diameter of 0.9 inches, and top diameter of 0.45 inches.
   01 For superior wheelchair mobility, truncated domes shall have a center-to-center (horizontally and vertically) spacing of 2.35 inches, measured between the most adjacent domes on square grid.

D. Configuration: Composite shell cast-in-place tactile warning surface unit sizes shall be as indicated on the Contract Drawings.
   01 For superior load bearing capacity, tactile warning surface units shall feature internal embedment ribs at 3” (nominal) on center maximum.
   02 The field area shall consist of a non-slip textured surface with a minimum static coefficient of friction of 0.80, wet and dry.
   03 At a minimum, tactile warning surface product thickness shall measure 0.20” (nominal).

E. Cleaning materials used on site shall have code acceptable low VOC solvent content and low flammability.

F. The Specifications of the concrete, sealants and related materials shall be in accordance with the Contract Documents and the guidelines set by their respective manufacturers.

G. Tactile warning surface is required at the base of all accessibility ramp connecting to vehicular traffic areas. Refer to Drawings.

H. Design is based on ADA Solutions Inc. Cast-In-Place Tiles; or equal. Product must meet all requirements of Americans with Disability Act (ADA) and Texas Accessibility Standards (TAS).

PART 3 - EXECUTION

3.1 SITE CONDITIONS

A. Prior to all Work of this Section, carefully inspect the installed Work of all other trades, and verify all such Work is complete to the point where this installation may properly commence. In the event of discrepancy, immediately notify the Architect. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

B. Remove all loose material from compacted sub-base immediately prior to placing concrete.

C. Verify that forms have been set to the grades and lines required and that they are rigidly braced and secured.

3.2 ENVIRONMENTAL CONDITIONS

A. Temperature:
   01 Do not place concrete in contact with frozen earth.
   02 Do not commence concrete placement unless temperature is at least 35°F (2°C) and rising, or slabs until the temperature rises above 40°F.
   03 Discontinue concrete placement when air temperatures exceed 95°F.

B. Do not place concrete during rain unless adequate protection is provided.

3.3 INSTALLATION – PAVING / FLATWORK JOINTS

A. General:
   01 Construct all joints true-to-line with face perpendicular to surface of concrete.
   02 Do not install joints which create acute angle shaped edges at the perimeter of the pavement sections. Minimum angle allowed shall be 60 degrees.

B. Load Transfer Joints: Unless specifically shown on the Drawings, the Contractor shall locate load transfer joints in accordance with the following schedule:
   01 Sidewalks: maximum distance between load transfer joints shall be 4 times the sidewalk width. Provide scored control joints in between expansion joints in equal intervals +/- the width of the sidewalk.
   02 Pavement Areas: load transfer joints shall be placed in each direction, in regular and evenly spaced intervals, to create pavement sections not to exceed 625 sq. ft. in a maximum size ratio of 1:1.5. Layout of proposed joint pattern must be approved by the Architect prior to installation.
   03 Seal all load transfer joints, continuous.

C. Redwood Expansion Joints:
   01 Isolate all catch basin and inlet grates with redwood expansion joints set in a diamond shape approximately 12” beyond the edge of the grate frame. Points of the diamond should correspond to load transfer joints.
   02 Install redwood expansion joints at all sidewalk and flatwork joints that are not otherwise load-transfer joints.

03 Seal all redwood joints, continuous.

D. Construction joints: obtain approval of Architect for locations and types of all proposed construction joints.

E. Flexible Expansion Joints:
01 Isolate all catch basin and inlet grates with flexible expansion joints set in a diamond shape approximately 12” beyond the edge of the grate frame. Points of the diamond should correspond to load transfer joints.
02 Install flexible expansion joints at all locations where flatwork or pavement is poured against a building foundation or other structural footing / beam.
03 Seal all flexible expansion joints, continuous.

F. Curing Compound:
01 Apply at all exterior concrete surfaces.
02 Apply complete covering of curing compound as soon as concrete is finished in strict accordance with manufacturer's standards and recommendations.
03 Coordinate with other trades as required to assure compatibility with any finishes to be applied over concrete surfaces.

3.4 INSTALLATION – PAVING / FLATWORK

A. Concrete Placement:
01 General: Comply with the provisions as specified in Section 03 30 00 – Cast-In-Place Concrete.
02 Deposit and spread concrete in a continuous operation. If interrupted for more than 45 minutes, place a construction joint.

B. Finishing:
01 All concrete flatwork and sidewalks shall receive a light broom finish, perpendicular to the run of the sidewalk.
02 All concrete pavement shall receive a medium broom finish, parallel to the direction of drainage.

C. Colored Concrete:
01 While concrete is still in the plastic stage of set, apply Bomanite Color Hardener prior to application of pattern. Apply at rate recommended by manufacturer, evenly to the surface of the fresh concrete by the dry-shake method. Apply in two or more shakes, floated after each shake and troweled only after the final floating.
02 While concrete is still in its plastic state, apply the tool/texture pattern to the surface of the concrete. Properly tamp tools into the surface to achieve the required texture, with uniformity of pattern and depth of stamping. Utilize bond breaker to keep tools from sticking to fresh concrete.
03 Release material shall be applied to the troweled surface prior to imprinting.
04 Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.
05 Apply secondary stain treatment per approved mock-up or as scheduled to achieve design.
06 Apply finish sealer per approved mock-up or as specified to achieve design required.

07 Apply Bomanite recommended Colorwax in accordance with manufacturer's printed instructions in colors to match the colored concrete selected.

D. Curing Compound:
01 Apply at all exterior concrete surfaces.
02 Apply complete covering of curing compound as soon as concrete is finished in strict accordance with manufacturer's standards and recommendations.
03 Coordinate with other trades as required to assure compatibility with any finishes to be applied over concrete surfaces.

E. Repairs and Protection:
01 After form removal, clean ends of joints and point up any minor honey combed areas. Repair or replace broken or defective concrete, as directed by the Architect.
02 Protect concrete from damage until acceptance of Work. Exclude traffic from pavement for at least seven (7) days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials.
03 Sweep all concrete pavement and wash free of stains, discolorations, dirt, and all other foreign materials just prior to final inspection.

F. At all exterior concrete penetrations where steel is in contact with the concrete, ensure fill is crowned so water does not stand, causing rust to form of metal object.

3.5 INSTALLATION – TACTILE WARNING SURACE

A. Contractor will not be allowed to install curb ramps until all submittals have been reviewed and approved by the Engineer.

B. Tactile warning surface product shall be installed per manufacturer’s instructions.

C. To the maximum extent possible, the tactile warning surface units shall be oriented such that the rows of in-line truncated domes are parallel with the direction of the ramp. When multiple tactile warning surface units regardless of size are used, the truncated domes shall be aligned between the tactile warning surface units and throughout the entire tactile warning surface installation.

D. In accordance with TDLR, Chapter 68.102 (Elimination of Architectural Barriers), tactile warning surface product shall be located so that the edge nearest the curb line is 6” minimum and 10” maximum from the curb line. This allows wheelchair users to gain momentum before traveling over the truncated domes and it provides visually impaired pedestrians additional time to react to the tactile warning surface or advanced warning before they reach the street.

E. The tactile warning surface units shall be tamped or vibrated into the fresh concrete to ensure that there are no voids or air pockets, and the field level of the tactile warning surface unit is flush to the adjacent concrete surface or as the Drawings indicate to permit proper water drainage and eliminate tripping hazards between adjacent finishes.

3.6 CLEANING AND PROTECTING - CONCRETE

A. Protect concrete paving and flatwork from damage during construction period. In the event of damage, make all necessary repairs and / or replacements required.

B. Clean and prep concrete paving and curbs prior to striping and painting. Adhere to paint manufacturer's specifications and recommendations.

C. Prior to final acceptance, thoroughly clean all paving and concrete work. Remove all tire tracks, rust stains, oil stains, dirt, excessive sealant, and other debris form the finished surface.

3.7 CLEANING AND PROTECTING – TACTILE WARNING SURFACE

A. Protect tactile warning surface unit against damage during construction period to comply with tactile warning surface unit manufacturer's specifications.

B. During and after the tactile warning surface unit installation and the concrete curing stage, it is imperative that there are no walking, leaning or external forces placed on the tactile warning surface unit to rock the tactile warning surface unit, causing a void between the underside of the tactile warning surface unit and the concrete.

C. As necessary, while the Project remains under construction, protect tactile warning surface units against damage from rolling loads following installation by covering with plywood or hardwood.

D. Clean tactile warning surface units not more than four (4) days prior to date scheduled for inspection intended to establish Date of Substantial Completion in each area of project. Clean tactile warning surface unit by method specified by tactile warning surface manufacturer.

END OF SECTION

SECTION 32 18 23.33

TRACK AND FIELD SURFACING

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Remove 5mm of existing track surface and recoat with 5 mm thick polyurethane track surfacing where indicated on the Drawings.
   02 Remove 5mm of existing track surface and recoat with 5 mm thick polyurethane track surfacing at field events as indicated on the Drawings; including high jump, long jump, triple jump and pole vault areas / runways.
   03 System shall include painted striping in accordance with IAAF and NFSHSA standards.
   04 The guidelines established in this specification are considered to be minimum acceptable standards for installing the track surface. Higher standards for materials and rates of applications of those materials as established in published and distributed specifications by individual and separate track surface manufacturers/installers shall not be lowered to comply with the minimum requirements set forth in this specification.

C. Related Work:
   01 Section 03 30 00 – Cast-In-Place Concrete
   02 Section 31 15 00 – Site Clearing and Earthwork
   03 Section 31 22 19 – Finish Grading
   04 Section 32 13 13 – Concrete Paving and Flatwork
   05 Section 32 18 23.60 – Track Striping

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show detailed, dimension drawings of all track and field surfacing.
   02 Show detailed, dimension drawings of all striping and painting.
   03 Show details of field fabrications, connections and details.

D. Installation Instructions: Submit manufacturer's complete installation instructions for all products and / or assemblies proposed to be furnished.

01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
02 Generic details that do not depict actual conditions may not be acceptable.

E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
01 Include recommended cleaning products and instructions for use.
02 Where applicable, provide recommended maintenance schedules and procedures.

F. Color / Finish Samples:
01 Provide two (2) samples of each finish for selection by the Architect.
02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
03 Minimum size shall be 3" x 3" but must be large enough to convey attributes of the proposed product.

G. Operations and Maintenance Manuals:
01 Provide complete operations and maintenance manuals to the Owner.
02 Refer to section 01 78 23 – Operations and Maintenance Manuals
03 O & M manuals must be reviewed, accepted and delivered to the Owner prior to Owner demonstration(s).

H. For warranties longer than one (1) year, submit a sample of the warranty proposed to be furnished.

I. Post Award Submittals:
01 The name of track surface supplier/installer to be associated with this project.
02 Manufacturer's technical specification for surfacing materials to be used, including rates of application and installation procedures.
03 Sample of track surface system to be installed. Mark each sample with trade name or designation identification.
04 Copy of Bidder's warranty for track surface system.

J. Prior to installation submit certificate, signed by track surface Contractor, stating asphaltic and Portland cement concrete pavements are acceptable and satisfactory for the installation of the resilient track surface system.

K. Post Installation Submittals:
01 Submit certificate, signed by track surface Contractor that the synthetic track surface work, including every component, complies with the requirements of the Contract Documents, and that the installation methods were adequate and proper for the conditions of installation and use.
02 Certified laboratory test for the installed track surface system showing compliance with IAAF requirements for force reduction, modified vertical deformation, friction and tensile strength.
03 Submit three copies of a manual describing the materials, devices, and procedures to be followed for use and maintenance of the synthetic track surface system, including the cleaning, paint application, and removal techniques. Include any precautions required by warranty.

04 Warranty for track surface installation.
05 Submit certification that running track length measured at prescribed location in lane 1 is in compliance with IAAF and NFSHSA standards and requirements.

1.3 QUALITY ASSURANCE

A. Track surfacing installation shall have a minimum of ten (10) years of experience in the installation of running track and track & field venues.

B. Weather Conditions:
01 Place no synthetic track surface, primers or any component of the track surface system when the air temperature is 55 degrees F and falling.
02 Materials may be placed after the air temperature is above 50 degrees F and rising.
03 Take air temperature readings in shade away from artificial heat.
04 Do not place any materials under wet or damp conditions.

C. System Performance Criteria:

01	Force Reduction	35% to 50% (50 to 104 degrees F)
02	Modified Vertical Deformation	0.6 to 1.8 mm (50 to 104 degrees F)
03	Friction	0.5 when wet
04	Tensile Strength	minimum 0.5 MPa
05	Elongation at Break	Minimum 40%

1.4 DELIVERY AND STORAGE

A. Deliver materials to project site in accordance with the construction progress schedule. Components shall be identified with manufacturers' original labeling and otherwise marked to indicate location of the Work. Store in dry location, protected against damage and according to manufacturers' recommendations.

B. All of the component materials to be used in the track surfacing shall be on site and audited by the Engineer before surfacing operations can begin.

C. All empty containers and bags shall remain on site until all track surfacing operations are complete. A final audit of materials will be made by the Engineer before empty containers and bags are removed and disposed of.

1.5 PRE-INSTALLATION MEETING

A. Prior to commencing installation of the work a meeting will be called at the project site to review material, installation procedures. Meeting shall include the track surface Contractor, Engineer and the Owner.

1.6 WARRANTY

A. Warranty: The track surfacing system shall be warranted against defects in workmanship, labor and materials under normal use and service for a period of five (5) years from Substantial Completion.
01 The warranty coverage shall not be prorated nor limited by amount of normal usage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Design of track and field surfacing is based on products and systems manufactured by epiQ Tracks as provided by Hellas Construction. No substitutions.

2.2 PRODUCTS

A. Design of track surfacing is based on epiQ Track Q3000 Track Surfacing System.

B. Primer: Polyurethane-based primer or as recommended by manufacturer, specifically formulated to be compatible with the substrate and track surfacing materials.

C. Polyurethane Binders:
   01 Binder: Polyurethane binder shall be a red pigmented two component system compounded from Polyol and Isocyanate components based on Methylene Diphenyle Isocyanate (MDI) considered to be Toluylene Diphenyle Isocyanate (TDI) free (non-toxic). The binder shall contain no mercury, lead or other hazardous toxic materials or clay fillers. The binder shall have none to low order and be ozone and fungus resistant. The binder shall have additives to prevent ultraviolet light degradation of the system. The binder shall have a consistent color for all applications. The mix of polyol and isocyanate shall contain no more than 60% polyol and no less than 40% isocyanate by volume.
   02 Impermeable Level-up: Two components red pigmented MDI based polyurethane mixed with 0.5mm to 2mm black SBR granules or red EPDM rubber granules as filler. Components shall be mixed to consistency so material will flow to fill low areas in existing pavements. Mixture shall consist of a minimum 75% polyurethane by weight of mixture.
   03 All polyurethane materials shall be US manufactured.

D. Rubber Granules:
   01 The rubber granules shall be recycled Styrene Butadiene Rubber (SBR), cryogenically processed K chopped and graded 1mm to 2mm in size with less than 4% retained on a No. 50 sieve.
   02 Granules shall not contain any trace of fiber or steel.
   03 Maximum allowable moisture content shall be 0.75%.

E. EPDM Granules:
   01 The EPDM granules shall be manmade, a minimum of 30% peroxide cured EPDM, chopped, processed and having a specific density of 1.6 +/- 0.08 gm/cc and a Shore-A hardness of 60 +/-5%.
   02 Sulphur-cured rubber is not acceptable.
   03 The granules shall be graded 1mm-3mm in size unless otherwise specified.

F. Line Marking Paint:
   01 Line marking paint shall be a non-petroleum latex-based product, specifically formulated to be compatible with polyurethane track surfaces.
   02 Reference section 32 18 23.60 – Track Striping.

2.3 EQUIPMENT

A. Mixer: Mixing of binder and shall be by a specifically designed mixing machine with automatic proportioning controls to meter the components of the binder such that the end product is compatible with climatic conditions. No hand mixing will be allowed.

B. Sprayer: Polyurethane primer shall be applied by airless spray equipment.

2.4 VAULT BOX PLUGS

A. Each pole vault box shall have a plug of track surface material. The bottom portion of the vault box plug shall consist of 50% polyurethane binder and 50% SBR granules. The 5mm top coat on the plugs shall be the same as the top coat on the athletic track.

PART 3 - EXECUTION

3.1 PREPARATION

A. Workmanship:
- 01 The track surfacing work shall be performed by an experienced specialty firm, which shall have installed a minimum of three (3) synthetic polyurethane track surface systems similar to the scope and specifications within the last two (2) years similar to the work required herein.
- 02 Track surfacing contractor shall be a member in good standing with the United States Tennis Court and Track Builders Association.
- 03 Track surfacing contractor shall have all required materials, system components and installation equipment on site prior to the start of any work so there will not be any delays in the installation process.
- 04 Prior to start of any work, coordinate with the Architect to determine if manufacturer's standard installation guidelines differ from these specifications; and fully resolve all differences prior to start of work.

B. Base Substrate:
- 05 Substrates shall be clean, dry and oil-free prior to start of track surfacing.
- 06 Prior to installation of the track surface material, the substrate shall be inspected for conformity to planarity requirements.
- 07 The substrate surface shall not deviate more than 1/8" in 10'-0" from the designated grade when checked with a 10' straight edge.
- 08 Prior to start of track surfacing work, the substrate surface shall be flooded with water to determine if low areas exist that could cause bird baths / ponding water on track surfacing when complete.
- 09 The areas not in conformance with the above requirements shall be corrected prior to start of track surfacing work.

C. Examination:
- 01 Prior to installation of any track and field work, including substrates, coordinate with other contractors as required to ensure prerequisite work is planned and installed as required for proper interface with track surfacing installation.

02 Thoroughly examine all substrate work to determine it is suitable for proper installation of track surfacing work.
03 Confirm all track equipment embedded in substrate is installed for proper interface with track surfacing.
04 Notify Contractor of any discrepancies and / or issues and do not proceed until fully resolved.

3.2 INSTALLATION

A. Impermeable Level-up.
01 Low areas in the pavement surface shall be filled and leveled prior to installation of track surface materials.
02 The entire low area shall be adequately filled to maintain allowable grades across the track surface.
03 Place polyurethane in single or multiple lifts as recommended by the manufacturer to ensure complete cure of the material for the thickness placed.
04 In areas receiving in excess of 4 mm thickness of material, SBR or EPDM granulate of 0.5 mm to 2 mm in size may be added to the polyurethane as filler at a ratio of 25% granulate and 75% polyurethane.

B. Priming:
01 The entire area to receive track surface mat shall be primed as recommended by the manufacturer.

C. Base Mat:
01 Base mat shall be comprised of multiple layers of a colored self-leveling flood coat of polyurethane.
02 SBR granulate 1mm to 3mm gradation is broadcast onto the flood coat.
03 Each layer shall consist of a minimum of 40-50% polyurethane and 50-60% rubber granulate and be a minimum of 5mm thick.
04 Rate of application of polyurethane shall be 1.0 to 1.15 lbs./SF. for 3mm and 4mm thickness respectively.
05 Loose granulate shall be removed before repeating the procedure for additional layers to obtain the desired total surface thickness.

D. Joints:
01 All joint work in base mat shall be flush with adjacent base mat.
02 Joints which have cured shall be primed with binder prior to laying an adjacent base mat.

E. Top Coat: Base mat shall cure for 24 hours before a top coat is applied.

F. Installation:
01 Topcoat is one layer of red colored self-leveling flood coat of polyurethane placed on the base mat.
02 The top layers is a minimum of 5mm thick.
03 Broadcast red pigmented EPDM granules 1mm to 3mm gradation on to the initial flood coat.
04 Broadcast red pigmented EPDM granules 1mm to 3mm gradation at a rate of 9 PSY on to the final coat prior to initial set of polyurethane so that the granulate is embedded into the flood coat.
05 After cure is complete, remove the excess granulate by sweeper.

06 The remaining embedded EPDM in the surface shall be equal to a minimum of 5 PSY.

07 The finished track surface shall have a minimum 10mm thickness when measured from the top of the embedded granulate to the bottom of the base mat.

G. Curing Time:

01 Initial set shall be substantially complete within 72 hours.

02 Final cure shall be substantially complete within 14 days, depending on weather conditions.

03 Use of surface shall be curtailed until final cure is substantially complete.

04 Track surface Contractor shall provide adequate measures to protect resilient surface during cure time

3.3 FINAL SURFACE TEST AND REPAIRS

A. After completion of track surfacing and curing, and before track striping operations, track shall be flooded with water to determine areas that may hold water.

01 All low areas holding water 30 minutes after rain or watering has stopped shall be clearly outlined so that necessary repairs can be made.

B. In areas holding water, the base mat shall be removed.

01 The size of the area to be removed will be determined by the Architect and / or Civil Engineer.

02 Surface of replaced base mat shall be on equal plane with adjacent surfaces

END OF SECTION

SECTION 32 18 23.53

TENNIS COURT SURFACING

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Work to be performed under these Specifications consists of furnishing all required labor, materials, and equipment required for tennis court surfacing in accordance with the Drawings, these Specifications, and the approved Shop Drawings.

C. Related Work:
   01 Fencing
   02 Site preparation
   03 Concrete perimeter beams

D. Cooperation by Contractor for Work of this Section of the Specifications with all other trades is mandatory, so that all phases of Work may be properly coordinated without delays or damage to any parts of any Work.

E. The Contractor shall provide all items, articles, materials, operations or methods listed, mentioned or scheduled on the Drawings and/or herein, including all labor, materials, equipment and incidentals necessary and required for their completion.

1.2 SUBMITTALS

A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.

B. Submit Shop Drawings detailing concrete and post-tensioning system.

C. Shop Drawings shall be sealed by a Structural Engineer registered in the State of Texas and retained by the tennis court installer.

1.3 INSPECTION

A. Inspect subgrade for proper compaction and stabilization provided under other Sections of these Specifications.

B. Inspect subgrade for proper slope to ensure that finished court surface will slope 1 inch per each 10 linear feet, as indicated on the Drawings.

1.4 QUALITY CONTROL

A. Work under this Section shall be provided by a qualified tennis court installer, approved by the Architect during the proposal period.

B. Installers:
   01 No Fault Industries, Inc.
   02 Robert W. Kurtz & Co., Inc.
   03 Tennis Management Services, Inc.
   04 Trans Texas Tennis, Inc.
   05 American Sports
   06 Australian Court Works
   07 Patriot Court Systems

C. Contractors Qualifications (submit the following with proposal):
   01 Submit proof he has operated under the same company name for past five (5) years.
   02 Provide a list of ten projects of similar size and scope successfully completed in the last three (3) years.
   03 Contractor is a member in good standing in the United States Tennis Court and Track Builders Association.
   04 All phases of tennis court construction shall be done by qualified tennis court contractor.

1.5 WARRANTY

A. The Contractor shall guarantee installation against defects in materials or workmanship for a period of one (1) year from date of substantial completion.

B. Guarantee shall protect against cracking of slab, or delamination or other failure of surfacing and striping. Color as selected by Architect.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The following manufacturers are acceptable provided proposed products meet or exceed all specified requirements:
   01 Laykold
   02 Plexi-Pave
   03 Tru-Flex
   04 TPS 5000 Acrylic Surfacer

2.2 MATERIAL

A. Colored acrylic tennis court surfacing per "Laykold Colorcoat Concentrate" or equivalent by specified manufacturer.

PART 3 - EXECUTION

3.1 CONCRETE

A. Forms: Forms shall be accurately set to the lines and grades indicated on Drawings and be securely staked to prevent settlement or movement during

placing of concrete. Forms shall remain in place until the concrete has taken its final set.

3.2 SURFACING AND STRIPING

A. Preparation:

01 Surface to be coated must be sound, free from loose dirt or oily materials and be thoroughly cleaned prior to coating. Any loose residual coatings must be removed by sandblasting and any hard or smooth troweled surfaces must be sandblasted.

02 New concrete must be cured at least eight (8) weeks before coating. Use moisture curing only. Use no chemical curing on surfaces to be coated.

03 Etch the surface by uniformly brooming a 10 to 20% solution phosphoric acid (approximately 6 parts water to 1-part acid). Apply the diluted acid at a rate of 20 gallons per 1,000 square feet. Allow the acid to react until the bubbling ceases. Thoroughly flush the entire etching and rinsing process with clean water, removing all residue. Repeat if there remains unexposed aggregate.

B. Prime Coat: Apply at the rate of approximately four gallons of diluted materials per 1,000 square feet. Use Colorcoat 100 mixed 2 parts to 1-part water or Colorcoat Concentrate mixed 1 to 3 with water. Allow to thoroughly dry before applying the finish course.

C. Finish Course:

01 Finish course shall consist of Colorcoat Concentrate. The finish course shall not be applied until the underlying surface is completely dry.

02 Colorcoat concentrate shall be applied at the rate of at least 12 gallons undiluted material per 1,000 square feet (.11 gal. per sq. yard, .5 liters per sq. meter) in at least 3 coats. The first two coats shall contain sand, #70-90 mesh. Final coat shall not have sand.

03 Maximum allowable addition of sand and water to the concentrate is 9 pounds of sand and 2/3 gallon of water to one gallon concentrate. The maximum allowable dilution with water only is one-part water to one-part concentrate.

04 The finished surface shall have a uniform appearance and be free of ridges, valleys and tool marks. After flooding with water, surface shall hold no "bird baths" deeper than 1/16 inch.

05 No parts of the construction involving Laykold materials shall be conducted during rainfall or when rainfall is imminent, or unless the air temperature is at least 50°F (10°C) and rising.

06 Use round sand only.

D. Playing Lines: After all color coats are completely dry, 2-inch wide playing lines shall be accurately located, marked, and painted with Laykold Line Paint (white).

END OF SECTION

SECTION 32 18 23.60

TRACK STRIPING

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers.

B. Scope of Work:
   01 This section provides for furnishing and installing lane striping, lane event markings and field event striping on a synthetic track surface for athletic track and field events.

C. Related Work:
   01 Division 2, Site Work
      a. Polyurethane Track Surface, Base Mat System.

1.2 SUBMITTALS

A. Submittals Before Starting Striping Operations:
   01 Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
   02 Detailed drawing (three copies) to the Engineer for review at least two weeks in advance of scheduled striping work. Drawing shall show all lane lines, starts, finishes and other event markings as indicated in this SECTION or on the contract drawings. Drawings shall be to scale.
   03 Stripes shall have one set of Engineer approved track striping drawings and project specifications at the project site before any striping operations can begin.
   04 In lieu of drawing submittal before striping operations, Contractor shall meet with Owner's representatives and Engineer and discuss in detail all proposed striping operations.

B. Submittals Upon Completion of Striping Operations
   01 Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
   02 Upon completion of the installation of the lines and markings for the track and field event areas, the Contractor shall furnish the Owner with a detailed drawing (six copies) showing all lines and markings as installed with appropriate identifying labels and color designations for all races. The drawing shall contain a statement that the lines and markings were applied in accordance with the latest edition of National Federation of State High School Associations, Track and Field Rules and the latest University Interscholastic League Rules and certifying the accuracy of the installation.

1.3 WEATHER CONDITIONS

A. No striping operations may proceed if air temperature is 55°F and falling. Striping may commence if temperature is 55°F and rising. Take temperature readings in shade away from artificial heat.

B. Do not place any paint under wet or damp conditions or when relative humidity is above 85%.

PART 2- PRODUCTS

2.1 MATERIALS

A. Paint. Moisture cured single component aliphatic urethane with pigment added to obtain desired colors. Acrylic, oil or alkyd base paints shall not be used.

B. Equipment. Line striping machine capable of producing neat lines with clear straight edges.

C. Other: Brushes, stencils and all other incidentals to complete the work.

PART 3 - EXECUTION

3.1 WORKMANSHIP

A. The track striping work shall only be performed by qualified personnel who are trained and experienced in working with the specified products and on athletic track installations. Striping personnel shall have completed at least five (5) track striping projects prior to starting this project.

B. The track striping Contractor shall inspect the track surface to insure compatibility of surface and paint products for the intended work. Commencement of striping operations shall constitute acceptance of the track surface by the track striping Contractor.

3.2 TRACK AND FIELD EVENTS LAYOUT

A. Governing Rules: All lines and markings shall be laid out for a 400 meter track with 42 inch wide lanes in accordance with the latest edition of National Federation of State High School Association, Track and Field Rules, University Interscholastic League Rules, or as specifically modified in this section. There is no raised curb on lane 1.

B. Calculation Standards.

01 If using feet, calculate to the nearest 0.001'
02 If using meters, calculate to nearest 0.0001 meters
03 One foot equals 0.3048 meters
04 Value of pi (π) equals 3.141593
05 Calculate angles to the nearest second by the formula:

$$\text{Angle} = \frac{\text{Arc Distance} \times 57.29578}{\text{Radius}}$$

C. Survey:

01 Personnel: All track lanes and markings and field events shall be laid out by a licensed professional engineer or a licensed land surveyor.

D. Equipment: All distances shall be measured with a certified steel tape corrected for temperature variations or an approved electronic distance meter. A Theodolite transit capable of reading direct to 20 seconds of arc shall be used for all angular measurements. Layout of lines and markings shall be made to the nearest 0.01 foot.

E. Track Events:

01 The track shall be laid out and painted to accommodate continuous lanes around the track. Each lane shall be located on the track surface as shown on the drawings. Lane lines shall overlap where the curved lines and the straight away line intersect. Use dashed lines for the straightaway lines through the intersection.

02 Races: The following metric races are to be calculated for staggered starts and laid out on the track surface for striping and marking.

100 M	Dash-(2 way)	4x200 M	Relay
200 M	Dash-(2 way)	4x400 M	Relay
400 M	Dash	100 M	Hurdles-(2 way)
800 M	Run	110 M	Hurdles-(2 way)
1600 M	Run	300 M	Hurdles
3200 M	Run	4x100 M	Relay

3.3 PAINTING

A. General.

01 Application

a. Apply paint at rate recommended by manufacturer of paint.

b. Coats: All lines shall receive one primer coat and one wear coat of paint. Paints shall be used directly from original containers and may not be thinned unless specified by manufacturer's directions printed on the label of the paint container.

02 Striping Contractor shall take all necessary precautions to prevent spillage of paint and any damage to track or field event area surfaces.

03 All empty paint containers shall remain at the site until final cleanup.

B. Track Events:

01 Lines: All lane lines and event start and finish lines shall be 2" wide unless otherwise noted. All lines and markings shall be straight and accurate. Ragged edges and crooked lines will not be accepted.

02 Event Marking Symbols: See sketches with this SECTION.

a. Relay Exchange Zone: Triangle with 40" base and 18" height measured from the center of the base. Triangles at each end of the zone shall point toward each other in the zone.

b. Relay Acceleration Zone: Triangle with 12" base and 6" height measured from the center of the base. Triangle shall point toward the exchange zone.

03 Hurdles: Triangle with 2" sides located on the lane lines or to the side of the lane line. Triangle shall point in the direction the race is to be run.

C. Color Codes:

01 Colors for all lines, exchange zones and hurdle marks shall be in accordance with the latest edition of the National Federation Track and Cross Country Rules.

02 Colors to be as indicated.

100m dash:	White
200m dash:	White
400m dash:	White
800m run:	Green
1600m run	White
4x100m relay:	White / Yellow Exchange
4x200m relay:	Black / Black Exchange
4x400m relay:	Blue / Blue Exchange
100m hurdles	White / Yellow Tabs
110m hurdles	White / Blue Tabs
300m hurdles	White / Green Tabs

Owner will verify the use of the above colors for the various races.

D. Special Markings:

01 Lane Numbers: Paint 3 foot high numbers in two colors for shadow effect. Base color shall be white. Four sets of numbers are required. Owner has option to request school logo or nickname to be painted on the track. Owner will furnish stencils for logo or nickname.

02 Identity Marks: Identify all lane markings by painting event identification onto track surface in 3" high letters in front of each mark in the right hand portion of the lane.

E. Field Events.

01 The edge of runways for long jump and pole vault shall be painted with 2" wide white lines.

02 The take off boards in the long jump runway shall be painted white.

03 The perimeter of the high jump apron shall be painted with 2" wide white lines.

04 Pole vault box shall be painted white.

3.4 CORRECTIONS

A. Striping Contractor shall be solely responsible for refurbishing track surface to original texture and color due to paint spillage; correction of errors in track striping and marking or damage caused by striping equipment.

3.5 CLEANUP

A. Striping Contractor shall remove all empty paint containers, rags and other painting accessories from the site. Partially used containers at least one-half full of paint shall remain at the site and become the property of the Owner at the Owner's option. All unused painting supplies shall remain the property of the Striping Contractor.

3.6 EXTENDED MAINTENANCE

A. Striping Contractor shall be responsible for restriping the entire track as well as all field eents in the third year of use, between 24 months and 36 months after substantial completion.

END OF SECTION

SECTION 32 31 13

CHAIN LINK FENCES AND GATES

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide chain link fencing in heights and at locations / configurations as indicated on the Drawings.
   02 Provide single and double chain link gates where indicated on the Drawings.
   03 Provide privacy slats at chain link fence adjacent to greenhouse.

C. Related Work:
   01 Section 03 30 00 – Cast-In-Place Concrete.
   02 Section 32 13 13 – Concrete Paving.

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.

D. Site Plan Drawings:
   01 Site plan (and more detailed plan where necessary) showing layout of all proposed chain link fencing and gates.
   02 Indicate height, size, material, and finish.
   03 Include details of post anchoring / footings, joints, attachments and clearances of all components.

E. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

F. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01 Include recommended cleaning products and instructions for use.
   02 Where applicable, provide recommended maintenance schedules and procedures.

G. Color / Finish Samples:
   01 Provide two (2) samples of each finish for selection by the Architect.
   02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
   03 Minimum size shall be 3" x 3" but must be large enough to convey attributes of the proposed product.

1.3 REFERENCES

A. American Society for Testing Materials:
   01 ASTM A90 – Standard Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
   02 ASTM A153 / A153M-16 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   03 ASTM A510 / A510M-20 – Standard Specification for General Requirements for Wire Rods and Course Round Wire, Carbon Steel, and Alloy Steel.
   04 ASTM A653 / A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   05 ASTM A924 / A924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
   06 ASTM F668 – Polyvinyl Chloride (PVC)-Coated Steel Chain Link Fence Fabric
   07 ASTM F900 - Standard Specification for Industrial and Commercial Swing Gates.
   08 ASTM F1043 - Specification for Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework.
   09 ASTM F1664 - Standard Specification for Polyvinyl Chloride (PVC)-Coated Steel Tension Wire Used with Chain Link-Fence.

B. Chain Link Fence Manufacturers Institute "Industrial Steel Specifications for Fence Posts, Gates and Accessories".

PART 2 - PRODUCTS

2.1 MATERIALS

A. Chain Link Fabric:
   01 Diamond mesh (2 inch), helically-woven and inter-woven.
      a. Provide 1-1/4" diamond mesh at tennis courts.
   02 Zinc-Coated Fabric: ASTM A392, with zinc coating applied to steel wire mesh fabric after weaving with the following minimum coating weight:
      a. Class 2 (ASTM A392) – not less than 2 oz./sq.ft. (610 g/sq.m) of uncoated wire surface.
   03 Wire Size: Minimum 9 gauge copper bearing steel wire, hot dip galvanized.
   04 Wire Tensile Strength: 70,000 PSI.

05 Twist and knuckle finish at top and bottom selvages (no exposed barbs).
06 Attach chain link fabric with 9 gauge galvanized tie wire or hog rings to top and mid rails at 18" O.C. maximum intervals. Attach 9 ga. tie wires to line posts at 15" o.c., minimum 6 per post.
07 Provide fabric fabricated in one-piece widths for fencing in height of 12 feet (3.6 m) and less. Comply with CLFMI's "Project Manual".

B. Framing:
01 All pipe components shall be fabricated from schedule 40 steel pipe; unless noted otherwise.
02 All components shall be hot dip galvanized.
03 All rails shall be located toward the inside of the site.

C. Fence Posts:
01 Posts for fences 6'-0" or less:
a. Line: 2-1/2" O.D.
b. Terminal / End / Corner: 3" O.D.
02 Posts for fences 6'-1" to 10'-0":
a. Line: 2-7/8" O.D.
b. Terminal / End / Corner: 3-1/2" O.D.
03 Line posts for fences 10'-1" or greater:
a. Line: 2-7/8" O.D.
b. Terminal / End / Corner: 4" O.D.
04 Line posts for tennis court fencing:
a. Line: 4" O.D.
b. Terminal / End / Corner: 6-5/8" O.D.
05 Provide conical tops at all posts, firmly secured in place.

D. Top and Bottom Rail:
01 Continuous top rail: 1-5/8" O.D. minimum. Provide at all fences, regardless of height.
02 Continuous bottom rail: 1-5/8" O.D. minimum. Provide at all fences 4'-0" or taller.
03 At fences without bottom rail, stretch minimum 9 gauge bottom tension wire taut between terminal posts. Securely anchor to each intermediate post 6 inches above grade and secure to fence fabric with hog rings at 24" O.C.

E. Mid Rails and Truss Braces:
01 Continuous mid rail: 1-5/8" O.D. minimum. Provide at all fences 6'-0" tall or taller.
02 Provide 5/16" truss rod and turnbuckle between terminal posts and adjacent posts.
03 Where required for stability and rigidity, provide 1-5/8" O.D. diagonal truss members between terminal posts and line posts.

F. Tension Bars and Wire:
01 Tension brace rod shall be minimum 3/8" with adjustable fitting.
02 Provide no.9 ga. Spring coil tension wire at of fence for fences shorter than 4'-0" tall.
03 Tension wire shall be fastened to every line post with heavy gauge steel
04 Tension rod to hook into brace rail cup or into brace band as solid unit fitting
05 At fences without bottom rail, stretch minimum 9 gauge, spring coil bottom tension wire taut between terminal posts. Securely anchor to

each intermediate post 6 inches above grade and secure to fence fabric with 9 gauge tie wires or hog rings at 18” O.C.

G. Swing Gates - ASTM F900:
   01 General: Gate frames shall be constructed of 2” round steel tubing of the sizes listed below.
   02 Person swing gates shall be joined at the corners by arc welding to form a rigid, one piece unit and filled with specified chain link fabric to match the fence. Hot-dip galvanize after fabrication. Coat welds with zinc base paint.
   03 Fasten fabric to the frame on all four sides by means of adjustable hook bolts and tension rods. Equip all gates with galvanized steel hinges and latch.
   04 Gate leaf width 3’-0” to 5’-0”: 2-1/4” O.D. 4.1 PLF, ASTM A120, galvanized schedule 40 pipe or 2-1/2 inch X 2-1/2 inch roll section, ASTM A501, hot dipped galvanized.
   05 Gate leaf width 8’-0” to 10’-0”: 4” O.D. 9.11 pounds per foot, ASTM A120, galvanized schedule 40 pipe or 3” x 3” roll section, ASTM A501.
   06 At gates 4’-0” or larger, provide vertical center brace bar, 1-21/32” horizontal brace and 3/8” tension brace rod with adjustable fitting at each leaf.
   07 At double leaf gates, provide an industrial-type gate latch with cane bolt drop rod and provision for padlock to secure one leaf. Provide a 2-3/8” O.D. pipe receiver in ground for drop rod. Imbed received in concrete minimum of 8” diameter by 12" deep. Provide a clip to secure the drop rod in the raised position when the leaf is open.

H. Swing Gate Hardware:
   01 Hinges: Provide male / female post type hinges.
      a. Two (2) per gate up to 72”.
      b. Three (3) hinges per gate 72” (+).
      c. Where designated, provide self-closing spring hinge(s).
   02 Standard Latches: Fork type latch capable of accepting (owner furnished) pad lock.
   03 Self-Closing Gate Latches: Provide self-latching latch capable of accepting (owner furnished) pad lock.
   04 Double Leaf Gate Latches: Provide 2-piece, heavy duty double-fork latch with 6” legs and slotted receiver; capable of accepting (owner furnished) pad lock.
   05 Crane Bolts / Drop Rods: At double leaf gates, provide a crane bolt drop rod to secure one leaf.
      a. Provide a receiver in ground for drop rod. Imbed receiver in concrete minimum of 6" diameter by 12" deep.
      b. Provide a clip to secure the drop rod in the raised position when the leaf is open.
   06 At any gate that does not receive an exit device, contractor shall supply and install chain and American padlock, keyed to District key 64335.
      a. Chain to be welded to fence and lock to be welded to chain.
      b. All welding to be performed by a certified welder.
      c. Provide five-year warranty against failed welds required.

I. Swing Gates With Exit Devices:
   01 Where indicated by finish hardware set (section 08 71 00) and/or gate schedule, coordinate as required to prep gates to receive exit devices or other specified hardware.

02 Mounting Plate to be 18”H, 16 gauge galvanized C-shaped channel with hemmed edges, welded to gate frame. Plate to extend full width of gate. Depth of flanges to exceed exit device depth by 2 inches.
03 Provide 9 gauge plate behind all components that require flat surface to mount to. Weld plate to post/rail. Grind welds smooth. Size of plates to be as required for mounting components.
04 Within 36” of exit device on gate and adjacent fencing, provide 12 gauge, expanded, galvanized steel or similar means to preclude reaching through fence and activating the exit device.
05 Provide one (1) self-closing hydraulic hinge and DINO hinges as required for three (3) total gate hinges minimum. Hydraulic hinge to be Mammoth 180-9005 (Silver) by Locinox. DINO hinge to be DINO 180º double bearing hinge by Locinox.
06 Provide one (1) HES 9500LBM strike latch receiver bracket.
07 Provide one (1) DAC Industries 6015 latch protector, 630 finish.
08 Provide 12” high x 2” deep x 3/16” thick panic/kick tube. Tube to be width of gate. Weld tube to each side of gate.
09 All components to be hot-dipped galvanized. Touch up galvanized finish with specified paint as required.
10 Coordinate horizontal intermediate chain link rail support (if required) with location of hardware and mounting plate.
11 Coordinate with Hardware supplier for balance of hardware required to ensure complete installation and operation of gate.

J. Privacy Slats: Polyvinyl Chloride (PVC) Coating:
01 Provide privacy slats for all chain link fencing adjacent to the greenhouse. Slats to be full height of fence and width to fit fence fabric.
02 Material: PVC.
03 Color: As selected by Architect from manufacturer’s full range of standard colors.

K. Wind Screen:
01 Provide 8 foot high wind screen fabric at all tennis court fencing.
02 Secure to wire mesh fabric as recommended by manufacturer.
03 Color to match existing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Spacing:
01 Space line posts at 8'-0" O.C. maximum.
02 Space pull posts where grade changes more than 30 degree slope.

B. Footings:
01 Line Posts: Set in minimum 10 inch diameter concrete footing a minimum of 36 inch post embedment in concrete, with a minimum 3 inch concrete cover at the bottom.
02 All terminal, corner, and pull posts: Set in minimum 12 inch diameter concrete footing, a minimum of 48 inch post embedment in concrete, with a minimum 3” concrete cover at the bottom.
03 Tennis court posts to be set in 16 inch diameter concrete footing a minimum of 48 inches deep with 3 inch cover.
a. Provide three (3) #3 reinforcing bars vertically and #3 reinforcing stirrups at 24 inches o.c.

04 Gate Posts: Set in minimum 24 inch diameter and 48 inch deep post embedment in concrete, with minimum 3 inch concrete cover at the bottom and No.4 U-shaped bars. Provide No. 3 tie bar placed above bottom of posts.

05 Concrete footing sizes and depths are based on holding top of footings +/- 4” below finish grade. Concrete exposed at finish grade shall not be accepted.

06 All concrete shall be 3,000 psi minimum (28 days), pea gravel aggregate.

07 Refer to section 03 30 00 – Cast-In-Place Concrete for additional information and requirements.

C. Install all chain link fencing and gates in strict accordance with Chain Link Manufacturers Institute recommendations.

01 Stretch fabric to proper tension between terminal posts and securely fasten to frame. Bottom of fabric shall be held as uniformly as practical to the finished grade.

02 Fasten chain link fabric securely to terminal posts with 3/16” x 3/4” tension bars and 11 gauge tie wires, spacing not to exceed 14 inches apart.

03 Tie fabric to rails with 9 gauge tie wires, spacing not to exceed 18” O.C.

04 Fencing shall be grounded every 1500 feet or within 100 feet of building or structures.

D. Gates (Swing): Install plumb and level. Adjust hardware for smooth operation.

END OF SECTION

SECTION 32 31 19

DECORATIVE FENCES AND GATES
(STEEL)

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 – GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Design, fabrication and installation of decorative steel fencing and gates.
   02 Refer to Drawings for fencing locations, panel design and gate sizes and locations.
   03 Proved all materials and accessories required for a complete installation.
   04 Coordinate with other trades as required for proper interface with finish hardware, access control systems and other electrical systems.

C. Related Work:
   01 Section 03 30 00 – Cast-In-Place Concrete
   02 Section 05 50 00 – Metal Fabrication
   03 Section 32 31 13 – Chain Link Fencing and Gates
   04 Section 32 31 26 – Traffic Gates

1.2 SUBMITTALS

A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.
   04 Site Plan Drawings showing complete layout of fencing, including gates, post sizes and locations and interface with adjacent work.
   05 If electrically-controlled gates are included, provide detailed Drawings indicating sizes and locations of electrical / control interface and stub-up locations. Coordinate with electrical contractor as required.
   06 Provide details for post installation, component connections, gates and gate hardware.

D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
   01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
   02 Generic details that do not depict actual conditions shall not be acceptable.

E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
   01 Include recommended cleaning products and instructions for use.
   02 Where applicable, provide recommended maintenance schedules and procedures.

F. Color / Finish Samples:
   01 Provide two (2) samples of each finish for selection by the Architect.
   02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
   03 Minimum size shall be 3" x 3" but must be large enough to convey attributes of the proposed product.

1.3 REFERENCES

A. ASTM International:
   01 ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
   02 ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
   03 ASTM A513 - Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing.
   04 ASTM F2408 - Standard Specification for Ornamental Fences Employing Galvanized Steel Tubular Pickets.

B. Refer to Sections 05 12 00 – Structural Steel Framing and 05 50 00 – Metal Fabrications for additional information and requirements.

1.4 WARRANTY

A. Manufacturer shall provide 20-year limited warranty to repair or replace failure of finish coating.
   01 Failure of finish coat shall include peeling, blistering, chipping, cracking, checking, caulking, excessive color change, fading and erosion.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Design of ornamental fencing and gates is based on Ameristar Montage Commercial - Majestic fencing as indicated on the Drawings.

2.2 GENERAL

A. Fence design(s), rail and picket configuration(s) and height(s) as indicated on the Drawings.
   01 Fence Height: As noted on drawings.
   02 Maximum Post-To-Post Spacing: 8’-0”.

B. Design bottom of fence to be a maximum of 4” above pavement, concrete flatwork or finished grade as applicable. Refer to Civil Drawings for additional information.

C. After fabrication, materials shall be hot dipped galvanized per ASTM A653 and A90.

D. Fence / Gate Finish:
   01 The manufactured galvanized framework shall be subjected to the PermaCoat® thermal stratification coating process (high-temperature, in-line, multi-stage, multi-layer) including, as a minimum, a six-stage pretreatment/wash (with zinc phosphate), an electrostatic spray application of an epoxy base, and a separate electrostatic spray application of a polyester finish.
   02 The base coat shall be a thermosetting epoxy powder coating (gray in color) with a minimum thickness of 2 mils (0.0508mm).
   03 The topcoat shall be a “no-mar” TGIC polyester powder coat finish with a minimum thickness of 2 mils (0.0508mm).
   04 All fencing and gates shall be coated inside and out.
   05 The color shall be as selected by the Architect from manufacturer’s full range of standard colors.

2.3 FENCING MATERIALS

A. Fencing shall be fabricated form components welded at all connections to form panels to be attached to posts set in the field.

B. Fencing Components:
   01 Guide Posts and Safety Posts: minimum 4” x 4” x 11 gauge.
   02 Line Posts: minimum 2-5/8” x 2-5/8”x16 gauge.
   03 Provide post caps at all posts.
   04 Rails: minimum 1-7/16” x 1.25” x 14 gauge.
   05 Pickets: minimum 3/4””x 16 gauge; spaced at 3-3/4” o.c. between pickets.

C. Swing Gate Components:
   01 Fabricate gates using same components specified for general fencing.
   02 Gate Posts: 4” x 4” x 11 gauge minimum.
   03 Hinges: Heavy duty, 1/2" minimum j-bolt / steel sleeve with washer and nut to secure hinge. Provide 3 hinges minimum per gate
   04 Provide 1/2" minimum crane bolts / drop rods and keeper sleeve.
   05 Operator: Provide hasp latch locking device for pad lock.
   06 Where indicated by finish hardware set (Section 08 71 00 – Door Hardware), coordinate as required to prep gates to receive exit devices or other specified hardware.
   07 At any gate that does not receive an exit device, contractor shall supply and install chain and American padlock, keyed to District key 64335.
      a. Chain to be welded to fence and lock to be welded to chain.

b. All welding to be performed by a certified welder.
c. Provide five-year warranty against failed welds required.

08 Provide other components and accessories required for a complete installation as recommended by the manufacturer.

D. Gate Interface with Hardware / Access Control:

01 At gates to receive exit devices:

a. Provide 18" high, 16 gauge, galvanized C-shaped, mounting plate with hemmed edges, welded to gate frame. Plate to extend full width of gate. Depth of flanges to exceed exit device depth by 1 inch.

b. Provide 9 gauge plate behind all components that require a flat surface to mount to. Weld pate to post/rail. Grind welds smooth. Size of plate to be as required for mounting components.

c. Within 36" of access exit device on gate and adjacent fencing, provide 12 gauge, expanded, galvanized steel ~~metal~~ or similar means to preclude reaching through fence and activating the exit device.

d. Provide one (1) self-closing hydraulic hinge and DINO hinge as required for three (3) total gate hinges minimum. Hydraulic hinge to be Mammoth 180 by Locinox. DINO hinge to be DINO 180º double bearing hinge by Locinox.

e. Provide one (1) HES 9500LBM strike latch receiver bracket.

f. Provide one (1) DAC Industries 6015 latch protector, 630 finish.

g. Provide one (1) aluminum Locinox gate stop with rubber bumper at each man gate leaf.

h. Bolts to be Mammoth-P00006000 quick-fix bolts.

i. All components to be hot-dipped galvanized. Touch up galvanized finish with specified paint as required.

j. Coordinate with Hardware supplier for balance of hardware required to ensure complete installation and operation of gate.

02 Coordinate with other trades as required for proper interface of access control devices or other electrical hardware.

a. Provide cut-outs and similar openings as required.

b. Provide means of gate / fence components being used as a wireway where required.

2.4 ATTIC STOCK

A. Provide the following attic stock:

01 Fence Panel: Provide ten (10) fence panels per campus of each height specified.

02 Fence Post: Provide ten (10) fence posts per campus.

03 Gate Hinge: Provide one (1) hydraulic gate closer and hinge (Mammoth-180-HD) per campus.

04 Gate Bolts: Provide five (5) quick fix bolts (Mammoth-P00006000) per campus.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General:

01 Complete installation in accordance with manufacturer's printed instructions and final reviewed submittals.
02 Install all posts plum and properly aligned in straight fence runs.
03 At radius or curved fence sections, install posts in segmented layout to create a smooth radius / curved appearance.
04 Space line posts at 8'-0" O.C. maximum.

B. Footings:
01 Line Posts: Set in minimum 12" diameter concrete footing a minimum of 36 inches, with a minimum 3" concrete cover at the bottom.
02 All terminal, corner, and pull posts: Set in minimum 12" diameter concrete footing a minimum of 36 inch post embedment in concrete, with a minimum 3" concrete cover at the bottom.
03 Concrete footing sizes and depths are based on holding top of footings +/- 4" below finish grade. Concrete exposed at finish grade shall not be accepted.
04 All concrete shall be 3,000 psi minimum (28 days). Refer to Section 03 30 00 Cast-In-Place Concrete.

C. Fabricate and install fencing such that pickets will uniformly follow within 4" of grade and / or concrete work below the fence.
01 Refer to Civil Drawings and grading plans for additional information.

D. Swing Gates:
01 Install plumb and level.
02 Adjust hardware for smooth operation, ensure cane bolts and drop rods align with sleeves.
03 Coordinate with other trades for installation of finish hardware required to be installed.

E. Grind all field welds smooth; and touch-up with cold galvanizing coating and finish coats to match prefinished fence color.

F. Cycle all swing gates to assure proper installation of all hardware and smooth operation.

END OF SECTION

SECTION 32 31 26

TRAFFIC GATES

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide decorative fence traffic gates (ornamental manual sliding gate) in heights and at locations / configurations as indicated on the Drawings.

C. Related Work:
   01 Section 03 30 00 – Cast-In-Place Concrete
   02 Section 10 10 00 – Misc. Specialties
   03 Section 32 13 13 – Concrete Paving
   04 Section 32 31 19 – Decorative Fences and Gates

1.2 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

C. Site Plan Drawings:
   01 Site plan (and more detailed plan where necessary) showing layout of all proposed traffic gates.
   02 Indicate height, size, material, and finish.
   03 Include details of post anchoring / footings, joints, attachments and clearances of all components.

D. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
   01 Show profiles, sizes, spacing and locations of assembled components.
   02 Show details of shop fabrications, connections and details.
   03 Show details of field fabrications, connections and details.
   04 Provide calculations demonstrating compliance with wind load and other requirements.
   05 Shop drawings shall be sealed and signed by a Texas registered engineer.

E. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.

01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
02 Generic details that do not depict actual conditions shall not be acceptable.

F. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
01 Include recommended cleaning products and instructions for use.
02 Where applicable, provide recommended maintenance schedules and procedures.

G. Color / Finish Samples
01 Provide two (2) samples of each finish for selection by the Architect.
02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
03 Minimum size shall be 3" x 3" but must be large enough to convey attributes of the proposed product.

H. Operations and Maintenance Manuals
01 Provide complete operations and maintenance manuals to the Owner.
02 Refer to section 01 78 23 – Operations and Maintenance Manuals
03 O & M manuals must be reviewed, accepted and delivered to the Owner prior to Owner demonstration(s).

I. For warranties longer than one (1) year, submit a sample of the warranty proposed to be furnished.

1.3 REFERENCES

A. American Society for Testing Materials:
01 ASTM A90 – Standard Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
02 ASTM A153 / A153M-16 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
03 ASTM A653 / A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
04 ASTM A924 / A924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
05 ASTM F668 – Polyvinyl Chloride (PVC)-Coated Steel Chain Link Fence Fabric.
06 ASTM F900 - Standard Specification for Industrial and Commercial Swing Gates.
07 ASTM F1043 - Specification for Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework.
08 ASTM F1664 - Standard Specification for Polyvinyl Chloride (PVC)-Coated Steel Tension Wire Used with Chain Link-Fence.

B. "Industrial Steel Specifications for Fence Posts, Gates and Accessories" by Chain Link Fence Manufacturers Institute.

C. Underwriters Laboratory:

01 UL325
02 UL991

PART 2 - PRODUCTS

2.1 MATERIALS – DECORATIVE FENCE TRAFFIC GATES (ORNAMENTAL MANUAL SLIDING GATE)

A. General:
- 01 Design of decorative fence traffic gates is based on Ameristar PassPort II Industrial Sliding Roll gate assembly.
- 02 Design shall be by the manufacturer as required for each location and opening width.
- 03 Traffic gates shall be complete assemblies, including supporting guide structure and accessories required for a smooth operating assembly.
- 04 Traffic gate shall be nominal 72” height. Length to be as indicated on drawings.
- 05 Gate shall be a roller supported assembly with gate supported by roller wheels on a “V” track.
- 06 Traffic gates shall be a 4-rail design and shall substantially match decorative fencing design / appearance. Refer to Section 32 31 19 – Decorative Fences and Gates.
- 07 Specific design of gates shall be by the manufacturer as required for each location and opening width; and shall match in general appearance.

B. Framing:
- 01 Steel material for fence panels and posts shall conform to the requirements of ASTM A653/A653M, with a minimum yield strength of 45,000 psi.
- 02 Top rails, Uprights and diagonal rails shall be 2” square tube, minimum 12 gauge.
- 03 Bottom rail shall be steel tube, 2” x 4” x minimum 11-gauge.
- 04 Material for pickets shall be 1” square x minimum 14-gauge tubing.
- 05 Picket spacing shall be 4” max.
- 06 Fence posts and gate posts shall meet be 4” x 4” x minimum 11 gauge.
- 07 All framing shall be located toward the inside / site side of the gate.
- 08 All primary frame components shall have welded connections.
- 09 Framing design shall be a truss type design with verticals at 72” O.C. maximum with diagonal truss bracing within each frame / bay.
- 10 Pickets, rails, uprights and posts shall be precut to specified lengths. Diagonals shall be precut to specified lengths and angles.
- 11 Roller support posts shall be minimum 4” x 4” x 12-gauge aluminum posts embedded in minimum 18” x 48” concrete footing. Minimum of two (2) support posts.
- 12 Completed gates shall be capable of supporting a 200 lb. load applied at midspan without permanent deformation.

C. Gate Rollers and Track:
- 01 Rollers at top of roller guide support structure shall be UHMW polyethylene rollers.
- 02 Gate shall be equipped with a minimum 6” diameter OHMW polyethylene V-groove, ball-bearing roller. Provide a minimum of two (2).
- 03 Track shall be 90 degree “V” shape galvanized steel track, flanged both sides for anchoring to concrete. Provide substantial anchors in concrete as required to assure.

04 Gate track beyond opening shall be installed on a nominal 18” wide, continuous 4” deep concrete pad / slab, curbed both sides with 6” x 6” standard curbs.

D. Decorative Fence Gate Finish: All fence components shall be subject to a six-stage pretreatment / wash followed by an electrostatic spray application of a “no-mar” TGIC polyester powder coat finish with minimum thickness of 2 to 4 mils.
01 Color as selected by the Architect from manufacturer’s full range of color selections to match decorative fence color.

E. Gate Components:
01 Contractor shall supply and install chain and American padlock, keyed to District key 64335.
a. Chain to be welded to fence and lock to be welded to chain.
b. All welding to be performed by a certified welder.
c. Provide five-year warranty against failed welds required.
02 Provide other components and accessories required for a complete installation as recommended by the manufacturer.

F. Operation: Manual.

PART 3 - EXECUTION

3.1 PREPARATION AND COORDINATION

A. Coordinate with Contractor and other trades for the installation of interfacing fencing work as required for the proper installation and operation of traffic gates.

B. Coordinate with Contractor and other trades for the installation of interfacing concrete work as required for the proper installation and operation of traffic gates.

3.2 INSTALLATION - GATES

A. Support structure posts footings shall be sized / designed by the gate manufacturer to be of sufficient size and depth for proper long-term operation of the gates.
01 All posts shall be set a minimum of 36” below finish grade / concrete slab in a minimum 16” diameter concrete footing.
02 Refer to Section 03 30 00 – Cast-In-Place Concrete for requirements of gate post footings.

B. Gate roller: 6” wheels shall be bolted to the gate (between the wheel plates welded near the ends of the gate bottom rail).
01 The gate shall be set upright with the V-grooved wheels positioned over the pre-installed steel V-track that traverses the gate opening.
02 Roller guides shall be affixed to the gateposts at a height even with the gate top-rail to hold the gate in a vertical position.
03 Gate stops shall be welded to the end of the gate or track so gate cannot pass rollers in either direction.

C. Install in strict accordance with manufacturer’s standards and recommendations.

3.3 TESTING

A. Upon completion of gate and operator installations, completely test all control functions to verify proper operation and functioning of gates.

B. Cycle each gate a minimum of ten (10) times for each control method.

C. Make necessary adjustments as required for proper function and operation.

END OF SECTION

SECTION 32 84 10
LANDSCAPE IRRIGATION

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

B. Scope of Work:
   01 Provide a complete underground sprinkler irrigation system in designated areas as indicated on the Drawings.
   02 Coordinate with Plumbing contractor for Main stub-out, install all backflow preventers, vacuum breakers and valves required and / or shown on the Drawings.
   03 Coordinate with Electrical Contractor for power and connection to irrigation controllers.
   04 System shall be complete, including, but not limited to the following:

C. Section Includes:
   01 Piping
   02 Manual valves
   03 Automatic control valves
   04 Automatic drain valves
   05 Sprinklers
   06 Quick couplers
   07 Controllers
   08 Boxes for automatic control valves

1.2 PERFORMANCE REQUIREMENTS

A. Irrigation zone control shall be automatic operation with controller and automatic control valves.

B. Intent of Drawings: Sprinkler lines shown on the Drawings are diagrammatic. Locations of all sprinkler heads, valves, piping, wiring, etc. shall be established by the Contractor at the time of construction. Spacing of sprinkler heads and quick coupling valves are shown on the Drawings and shall be exceeded only with the permission of the Owner's authorized representative.

C. Keep all areas of work clean, neat, and orderly at all times. Keep paved areas clean during installation operations.

1.3 SUBMITTALS

A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.

B. Product Data: For each type of product indicated, provide manufacturer's literature, include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories to demonstrate compliance with the specified requirements.

C. Wiring Diagrams: For power, signal, and control wiring.

D. Delegated-Design Submittal: For irrigation systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Zoning Chart: Show each irrigation zone and its control valve.

F. Controller Timing Schedule: Indicate timing settings for each automatic controller zone.

G. Field quality-control reports.

H. Operation and maintenance data for the following:
- 01 Irrigation controller.
- 02 Valves and gate valves.
- 03 Pipe and fittings.
- 04 Valve boxes.
- 05 Quick coupling valves.
- 06 Low voltage wire and connections.

I. Record Irrigation Drawings:
- 01 Furnish Record Drawings of complete irrigation system in accordance with the General and Special Conditions.
- 02 Procure full size, electronic set of Contract Drawings from Landscape Architect.
  - a. Construction Drawings shall be on-site at all times while irrigation system is under construction.
  - b. Make daily record of all work installed each day.
  - c. Actual location of valves and quick couplers and all irrigation and drainage piping shall be shown on prints by dimensions from easily identifiable permanent features, such as buildings, light poles, curbs, fences, walks, or property lines.
  - d. Drawings shall show approved substitutions of material. Include material, manufacturer's name, and catalogue number.
  - e. Drawings shall be to scale and all indications shall be easily understandable, legible, and neat.

1.4 QUALITY ASSURANCE

A. Requirement of Regulatory Agencies:
- 01 All work and materials shall be in full accordance with the latest rules and regulations of safety orders of Division of Industrial Safety; the Uniform Plumbing Code and other applicable laws or regulations, including the City of Houston or other local governing body.
- 02 Nothing in Drawing is to be construed to permit work not conforming to these codes. Should the Contract Documents be at variance with the aforementioned rules and regulations, notify Landscape Architect and get instructions before proceeding with the work.
- 03 If it is found, and decided by Landscape Architect and the Owner that these plans, details and/or specifications are not being followed or installed correctly by the Irrigation Contractor (IC), requiring additional trips to verify quality or completion of this work, it will be the responsibility of the IC to pay the LA for additional site visits for verification and compliance of this work. Normal billable rates will apply with a three hour minimum including travel one way.

B. Testing:
- 01 Preliminary review of completed installation will be made by the Landscape Architect prior to backfilling trenches and during hydrostatic testing.
- 02 Final review shall be made in conjunction with the final review, shrubs, and tree planting.

03 The contractor is responsible to call the Landscape Architect (LA) and set up a time for the above, 24-48 hours in advance.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.5 FINAL ACCEPTANCE

A. Work under this Section will be accepted by Landscape Architect upon satisfactory completion of all work. Upon final acceptance, Owner will assume responsibility for maintenance of the work. Said assumption does not relieve Contractor of obligations under Warranty.

1.6 WARRANTY

A. In addition to the manufacturer's guarantees or warrantees, all work shall be warranted for one (1) year from the date of Final Acceptance against defects, material, equipment and workmanship by the Contractor. Warranty shall also cover repair of damage to any part of the premises resulting from leaks or other defect in materials, equipment, and workmanship to the satisfaction of the Owner.

B. Contractor shall not be held responsible for failures due to neglect by the Owner, vandalism, etc., during the Warranty or Guarantee period. Report such conditions to the Landscape Architect in writing.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials throughout the system shall be as specified and noted on the Drawings, new and in perfect condition.

B. Submit shop drawings to the Landscape Architect for review prior to installation.

C. Gate Valves: Three inches in size and under, use 125 pound bronze construction, non-rising stem type, sized to line specified on the plan. NIBCO #T113 or approved equal.

D. Sleeves: Control wire and water line sleeves shall be PVC 1120-1220, Schedule 40 pipe.

E. Irrigation Controllers: **(N/A)** As shown on Drawings.

F. Control Wiring: Solid copper wire, UL approved for direct burial in ground, 14 gauge, type UF with plastic insulation and 600 volt rated. Use 12ga. UF for runs over 1,000 linear feet. Common ground wire shall be white, Red for valves, yellow for tree bubblers, green for mainlines, orange and blue for “extra” valve wire runs.

G. Valve Boxes: These Boxes shall be 14”x19”x12” minimum, injection molded of polymers and fibrous inorganic temperature resistant components. Box shall provide adequate clearance to operate and service valve. Box and lid shall be green in color.
01 Acceptable Manufacturers: NDS, Amtek, Christy, Carson, or approved equal.
02 Valve boxes, Gate Valves, Wire Connector Boxes and Quick Coupler Boxes
03 See details for additional information.

H. Quick Couplers: **(N/A)**
01 Valve and keys as specified on Drawings.
02 Furnish two valve keys fitted with 3/4-inch swivel hose ells.

I. Sprinkler Heads: As shown on Drawings.

J. Conduit: All conduit for low voltage irrigation control wires shall be 2-inch Schedule 40 PVC. Control wiring may be placed in common sleeve with lateral or main lines under paving when sleeves are larger than 4-inches.

K. Backflow Device: **(N/A)** Provide backflow preventers, per plan on irrigation lines connected to domestic water lines in accordance with section 15140. If a PVB is allowed use FEBCO 765, if RPZ is required, use WATTS 909, either shall be brass only.

L. Backflow Protection: **(N/A)** Protect backflow with a lockable cage, see details.

M. NOTE: Provide a clay dam at piping trenches where piping crosses building perimeter grade beams to prevent water traveling pipes to area below slabs.

2.2 PIPING

A. General
- 01 No Class Pipe to be used.
- 02 Schedule 40 Pipe, continuously and permanently marked with the manufacturer's name or trademark, size, schedule and type of material, working pressure at 73 degrees F., SDR number, ASTM standard number and the NSF (National Sanitation Foundation) seal.

B. Piping on pressure side of irrigation control valves:
- 01 Two inch diameter and smaller pipe – ASTM D1785, PVC 1120-1220 compound, Schedule 40.
- 02 Two to three (2”-3”) pipe – ASTM
- 03 Lay a “tracer wire” in, next to ALL Main Lines installed and back to the controller and labeled for future use. The wire spec is the same as the valve wires, the color shall be green.

C. Piping on non-pressure side of irrigation control valves:
- 01 Two inch diameter and smaller – ASTM D1785, PVC 1120-1220 compound, Schedule 40.

2.3 FITTINGS

A. General
- 01 PVC pipe and fittings shall be suitable for solvent weld, slip joint ring, tight seal or threaded connections.
- 02 Pipe on side of Valves shall have a minimum of 18" offset to mainlines or other fittings on either end.
- 03 Do not use 1-1/4” or 1/2" pipe.
- 04 Fittings on all mains shall be schedule 80.
- 05 Fittings on all lateral lines shall be schedule 40, Type 1.
- 06 All threaded fittings shall be schedule 80, (if any at all).

B. Fittings for Solvent- Welded Pipe:
- 01 Schedule 40, polyvinyl chloride, standard weight, as manufactured by "Sloane", "Lasco", or approved equal, to meet ASTM D2466-73 and D-2467-73.
- 02 Threaded PVC nipples - Schedule 80 PVC.

C. Fittings for Swing Joints:
- 01 Use IPS PVC Flex Hose with Weld-On 795 PVC Clear Transparent Glue for standard schedule 40 fittings.
- 02 No “poly pipe” is to be used anywhere on site.
- 03 Provide Teflon tape on all threaded connections except on the Irrigation head body.

04 Size of pipe shall be according to flow requirements and detailed notes.

2.4 PIPING JOINING MATERIALS

A. Glue and Primer:
   01 Pipe Primer: Christy's Purple Primer to be used on all pipe joints, ASTM F656.
   02 Pipe Cement: Christy's Red Hot Blue to be used on all pipe joints 3" or smaller, ASTM D2564.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions:
   01 Contractor shall be acquainted with all site conditions. Should utilities or other work not shown on the plans be found during site visit or excavations, Irrigation Contractor (IC) shall promptly notify Landscape Architect for instructions prior to further action. Failure to do so will make Contractor liable for any and all damage arising from operations subsequent to discovering of such items or utilities not shown on plans.
   02 Contractor shall take necessary precautions to protect site conditions. Should damage be incurred Contractor shall repair damage to its original condition or furnish and install an equal or better replacement.

3.2 LAYOUT

A. Consideration will not be given to any design changes until after award of contract.

B. Lay out work as closely to that shown on the Contract Drawings as possible. Contract Drawings are diagrammatic in nature. Adjust layout as necessary to accommodate actual site conditions. Locate pipe and valves shown under paving in adjacent planting areas.

C. Full and complete coverage is required. Contractor shall make minor adjustments to layout as required to assure full and complete coverage. When such adjustments require exceeding radius limitations shown on irrigation legend, IC shall contact Landscape Architect for direction.

D. Substitutions for smaller pipe sizes or types will be not be accepted or approved.

3.3 EARTHWORK

A. After final grading has been performed and accepted, perform excavation as required for installation of work included under this Section, including shoring of earth banks if necessary. Restore all surfaces, existing underground installations, etc., damaged or cut as a result of excavations, to their original condition.

B. Irrigation Contractor, (IC) and GC shall study these plans and the latest Survey of this site in case new utilities are discovered before trenching proceeds. Should utilities not shown on the plans be found during excavation, promptly notify General Contractor and Landscape Architect for instructions as to further action. Failure to do so will make Contractor liable for any and subsequent discovery of such utilities. Indicate such utility crossings on the Record Drawings promptly.

C. Dig trenches wide enough to allow a minimum of 3-inches of fill between parallel pipe lines. Trenches shall be of sufficient depth of proved minimum cover from finish grade as follows:
   01 Over pipe on pressure side of irrigation control valve, control wires and quick coupling valves: 18 inches.

02 Over pipe on non-pressure side of irrigation control valve: 12 inches.

D. Trenching within the drip-line of existing trees shall be dug by hand only without severing roots which exceed 1-1/2' in diameter. Notify the Landscape Architect immediately if site conditions prohibit such action. Tunnel under or over roots, still at minimum requirements and allowing at least 3" soil space to the root.

3.4 PIPING INSTALLATION

A. General:
- 01 Location and Arrangement: NOTE: Drawings indicate location and arrangement of piping systems. Install piping as indicated unless deviations are approved and initialed by LA on Coordination Drawings.
- 02 Keep all pipes and fittings clean and free of dirt and moisture before assembly using a temporary cardboard or plastic matt.
- 03 Lay piping on solid subbase, uniformly install piping free of sags and depressions. See "snaking" requirements note below.
- 04 Install groups of pipes parallel to each other, spaced to permit dirt layers between main lines, laterals and to allow valve servicing.
- 05 Install fittings for changes in direction and branch connections.
- 06 Install expansion loops, as needed, in valve boxes for plastic piping.
- 07 Install PVC piping in dry weather when temperature is above 40 degrees F. Allow joints to cure at least 24 hours at temperatures above 45 degrees F. before testing.

B. Solvent-Welded Joints for PVC Pipes:
- 01 Use solvents and methods by pipe manufacturer
- 02 Cure joint a minimum of one hour before applying any external stress on the piping and at least twenty four (24) hours before placing the joint under water pressure.

C. Threaded Joints for Plastic Pipes:
- 01 Use Teflon tape on the threaded PVC fittings, ONLY at Main line tie-ins.
- 02 Use strap-type friction wrench only. Do not use metal-jawed wrench.
- 03 When connection is plastic to metal, male adaptors shall be used. The male adaptor shall be hand tightened, plus one turn with a strap wrench. Joint compound shall be Teflon tape or approved equal.

D. Joints for Polyethylene Pipes:
- 01 NO Poly pipe to be used, only flexible PVC, see specs above.

E. Laying of Pipe:
- 01 NOTE: Pipes shall be bedded in at least 2-inches of finely divided material, preferably sand or a sandy loam with no rocks or clods over 1-inch diameter to provide a uniform bearing.
- 02 Pipe shall be "snake" from side-to-side of trench bottom at least every 40 ft. to allow for expansion and contraction along with the 'main line trace wire'. One additional foot per 100 feet of pipe is the minimum allowance for snaking.
- 03 Do not lay PVC pipe when there is water in the trench.
- 04 Install plastic pipe in a manner to provide for expansion and contraction as recommended by the manufacturer.
- 05 Cut plastic pipe with PVC pipe cutters to ensure a square cut. Remove any burrs at cut ends prior to installation to ensure that a smooth unobstructed flow will be obtained.
- 06 All plastic-to-plastic joints shall be solvent-weld joints or slip seal joints as specified shall be used. Install plastic pipe and fittings as outlined and instructed by pipe manufacturer. It shall be the Contractor's responsibility to make arrangements with the pipe manufacturer for any field assistance that may be necessary. Contractor shall assume full responsibility for the correct installation.

3.5 EQUIPMENT INSTALLATION

A. Gate Valves: Group valves together per plan where possible, minimum of two together, no isolated valves by themselves. Box shall be flush with finish grade.

B. Irrigation Control Valves:

01 Install control valves in valve boxes as shown and group at least two together minimum.
02 Place Valves no closer than two feet from Mainlines, three feet to walk edges, buildings, or walls. Valve boxes shall be flush with finish grade with a strip of sod around the boxes.

C. Sprinkler Heads:
01 Place all rotary pop-up sprinkler heads in lawn areas on swing joints as Detailed on Drawings with top of heads. Place part-circle rotary pop-up sprinkler heads 6-inches from edge of and flush with top of adjacent walks, header boards, curbs, mowing bands, or paved areas at time of installation. Install rotary sprinklers on a swing joint assembly as detailed.
02 Install spray heads and bubbler heads on a swing joint assembly as detailed on the Drawings.

D. Quick Coupling Valves: Install quick coupling valves on a swing joint assembly as detailed on the Drawings.

E. Automatic Controller: **(N/A)**
01 Install per local code and manufacturer's latest printed instructions.
02 Connect remote control valves to controller in clockwise sequence to correspond with station setting beginning with Stations 1, 2, 3, etc. per Plan.
03 Affix controller name (i.e. "Controller A") on inside of controller cabinet door with letters minimum of 1-inch high.
04 Affix a non-fading copy of irrigation diagram to cabinet door below controller name. Seal irrigation diagram between two sheets of 20 mil (minimum) plastic.
05 Irrigation diagram shall be a reduced copy of the as-built drawing and shall show clearly all valves operated by the controller, showing station number, valve size, and noted as ‘Spray Beds’, ‘Spray Lawn’, or ‘Rotor Lawn’.

F. Control Wiring:
Install control wires with sprinkler mains and laterals in common trenches wherever possible. Lay to the side of pipe line. Provide looped slack at valves and snake wires in trench to allow for contraction of wires. Tie wires in bundles at ten (10') foot intervals.
01 Crimp and seal control wire splices at remote control valves with specified splicing materials. Line splices will be allowed only on runs of more than 500 feet. Line splices to be Scotchlok and sealed with Scotchkote sealer.
02 Install a minimum of two, (2) extra control wires, to the control valve located the greatest distance from the controller in BOTH directions, blue on one side and orange in the other direction, label each end blanks.

G. Closing of Pipe and Flushing of Lines:
01 Cap or plug all openings as soon as lines have been installed to prevent entrance of materials that would obstruct the pipe or heads. Leave in place until removal is necessary for completion of installation.
02 Thoroughly flush out all water lines before installing heads, valves and other hydrants.
03 Test as specified.
04 Upon completion of testing, complete assembly and adjust sprinkler heads for proper distribution.

05 All sprinkler heads and quick coupling valves shall be set perpendicular to finished grades unless otherwise designated on the Drawings, or otherwise specified. Sprinkler heads adjacent to existing walls, curbs and other paved areas, shall be set to grade. Sprinkler heads which are to be installed in lawn areas where the turf has not yet been established shall be set 1/2-inch above the proposed finish grade. Heads installed in this manner will be lowered to grade when the turf is sufficiently established to allow walking on it without appreciable destruction. Such lowering of heads shall be done by Contractor as part of the original contract with no additional cost to the Owner.

3.6 BACKFILL AND COMPACTING:

A. After system is operating and required tests and inspections have been made, backfill excavations and trenches half-way, with clean soil free of debris, then "water-in" soil and tampen to remove air pockets, then repeat this process with the balance of the material.

B. Backfill for all trenches, regardless of the type of pipe covered, shall be compacted to minimum 95 percent density under pavements, and 85 percent under planted areas.

C. Compact trenches in areas to be planted by thoroughly flooding backfill. Jetting process may be used in those areas.

D. Dress off all areas to finish grades.

3.7 WARRANTY

A. The Contractor shall warrant all materials and workmanship for one (1) year from final acceptance.

3.8 CLEAN UP

A. Clean up and remove all debris from the entire work area prior to Final Acceptance to satisfaction of Landscape Architect.

3.9 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Perform hydrostatic tests when welded PVC joints have cured per manufacturer's instructions.
   01 Pressurized Mains:
      a. Completely install mains, gate valves, and control valves. Do not install laterals.
      b. Fill all lines with water.
      c. Pressurize the main with air to 70 psi. Monitor gauge for pressure loss for four (4) hours. Maximum allowable loss over four (4) hour period - 3 psi.
      d. Leave lines and fittings exposed throughout testing period.
      e. Leaks resulting from tests shall be repaired and tests repeated until the system passes.
      f. Test all gate valves for leakage.
   02 Non-Pressure Laterals:
      a. Test piping after laterals and risers are installed and system is fully operational.
      b. Leave trenches open to detect possible leaks.

C. Submit written requests for inspections to the Landscape Architect at least forty eight (48) hours prior to anticipated inspection date.

D. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

01 Operational Test: After electrical circuitry has been energized, operate controllers and automatic control valves to confirm proper system operation.

02 Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Any irrigation product will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports, submit to Landscape Architect.

3.10 ADJUSTING

A. Adjust settings of controllers.

B. Adjust automatic control valves to provide flow rate at rated operating pressure required for each sprinkler circuit.

C. Adjust sprinklers and devices, except those intended to be mounted aboveground, so they will be flush with, or not more than 1/2 inch above, finish grade.

END OF SECTION

SECTION 32 92 13

HYDRO MULCHING

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB - Instructions to Proposers and Section AF – Subcontractor and Manufacturer Prequalification for substitutions.

B. Scope of Work:
   01 Stand of Grass: 20 growing plants per square foot.
   02 All improved areas including lawn, planting, landscaping areas

C. Related Work:
   01 Section 31 15 00 – Site Clearing and Earthwork
   02 Section 31 21 19 – Finish Grading
   03 Section 32 84 23 – Underground Sprinklers
   04 Section 32 92 23 – Solid Sodding

1.2 SUBMITTALS

A. Provide all submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Test Reports: Results of seed purity and germination tests.

C. Certificates: Manufacturer's certification that materials meet specification requirement.

1.3 QUALITY ASSURANCE

A. Source Quality Control: Producer's test for purity and germination of seed, dated within nine months of sowing.

B. Comply with recommendations of “Official Method of Analysis”, Association of Official Analytical Chemists.

C. Deliver fertilizer to site in bags or other convenient containers, each fully labeled conforming to applicable State fertilizer laws, and bearing name, trade name or trademark, and warranty of producer.

D. Do not perform seeding when wind exceeds 15 MPH, or when excessively wet or dry.

E. Restrict foot and vehicular traffic from seeded areas after planting to end of established period.

F. Immediately after seeding, erect barricades and warning signs as required to protect seeded areas from traffic until grass is established.

1.4 WARRANTY

A. Provisional Acceptance: Planting reviewed as being in accordance with specifications.

B. Guarantee Period: Guarantee stand of grass for 90 days after provisional acceptance or upon substantial completion of the entire project, whichever is later.

1.5 CONTRACTOR'S MAINTENANCE

A. The Contractor's maintenance of new hydro-mulch areas shall consist of watering, cultivating, weeding, mowing, edging and fertilizing every week, and furnishing and applying such sprays and invigorates necessary to keep hydro-mulch free from insects and diseases, and in thriving condition and mowing of entire site until the substantial completion or until the planting density / requirements have been met, whichever is later.

B. Protect hydro-mulch areas at all times against damage of all kinds for the duration of Maintenance Period. Any plants damaged or injured, because sufficient protection was not provided, shall be treated or replaced by the Contractor, as directed by Owner, at no additional cost to the Owner.

C. See following maintenance frequency schedule.

MAINTENANCE FREQUENCY SCHEDULE

Mowing, Edging, Trimming, Litter Clean Up, and Irrigation Monitoring:

Month	Number of Visits Per Month (minimum)
January	2
February	2
March	4 (Start up irrigation system)
April	4
May	5
June	4
July	5
August	5
September	5
October	3
November	2 (Shut down irrigation system)
December	2

01 Top Dress Fertilizer: Thirty (30) days after seeding.
02 Weeding and Weed Control: As required at each visit.
03 Reseeding: As required upon notice.

1.6 FINAL ACCEPTANCE

A. Work under this section will be accepted by the Owner upon satisfactory completion of all work, including maintenance, but excluding replacement of plant material under the warranty period. Upon substantial completion, the Owner will assume responsibility for maintenance of the work.

B. Grass shall be sound, healthy and vigorous. All areas shall be free from disease, insect pests, eggs, or larvae and shall have healthy, well developed root systems. They shall be free from physical damage or adverse conditions that would prevent thriving growth.

C. Hydro-mulch shall be deemed acceptable to transfer to the Owner when it meets the above conditions and additionally has achieved a minimum 95% coverage of all areas to which it was applied. All areas shall remain the responsibility of the Contractor until this condition is met.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Seed:
All seed must meet the requirements of U.S. Department of Agriculture Rules and Regulations as set forth in Federal Seed Act and Texas Seed Law. Type of seed, purity and germination requirements, rate of application and planting dates are as follows:

01 Summer blend: 2# Bermuda, 15 # 13-13-13 water soluble fertilizers applied at a rate of 1 lb. per 1000 sq ft or 50 lbs per acre.
02 Fall/Winter blend: 3-4# unhulled Bermuda, 2# gulf rye, 15# 13-13-13 water soluble fertilizer applied at a rate of 1 lb. per 1000 sq ft or 50 lbs per acre.
03 Quality of seed shall be no less than 98% pure seed with an 85% germination rate.

B. Fertilizer:
Fertilizer shall be water soluble with analysis of 15 percent nitrogen, 15 percent phosphoric acid, and 15 percent potash. Rate of application shall be 750 pounds per acre, except during the period of April 15 thru September 1, when the rate shall be reduced to 600 pounds per acre.

C. Hydro-seed mixture shall include wood fiber, specifically made for hydroseeding, mixed with water. Mix wood fiber according to manufacturer's specifications. Rate of application shall be 3,000 pounds per acre.

PART 3 - EXECUTION

3.1 INSPECTION

A. Check that preceding work affecting ground surface is completed.

B. Verify that soil is within allowable range of moisture content.

C. Soil is to be free of weeds and foreign material immediately before seeding.

3.2 HYDRO-MULCHING

A. Preparation:
01 After designated areas have been completed to lines, grades and cross-sections shown on drawings, perform seeding.
02 Cultivate areas to be seeded to depth of 4 inch minimum.

03 Cultivate seed-bed sufficiently to reduce soil to state of good tilth; seed-bed shall be deemed in state of good tilth when soil particles on surface are small enough and lie close enough together to prevent seed from being covered too deep for optimum germination.
04 Cultivation of seed-bed will not be required in loose sand where depth of sand is 4 inches or more.
05 Maintain cross-section previously established throughout process of cultivation; do any necessary reshaping prior to any planting of seed.

B. Location: as noted in Paragraphs 1.5 and 2.1, A.

C. Application:
01 Mow existing weeds as close as possible and disc 3 -4 inches to prepare seed bed.
02 Perform seeding as described in Section 2.01, A.
03 Seeding which is extended beyond most favorable planting season for species designated shall be done only when conditions are favorable, or when alternate or corrective measures have been taken.
04 Cultivated area or seed-bed shall have relatively smooth surface without ruts or tracks.
05 Hydraulically spray slurry on ground to form a blotter-like ground cover uniformly impregnated with grass seed. This application will allow absorption of moisture, thus allowing rainfall or mechanical watering to percolate to underlying soil.
06 Roll area with cultipacker for optimum seed to soil contact.
07 Accomplish application of mulch slurry immediately upon completion of final tillage.
08 Apply fertilizer and mulch as described in Section 2.01, A.
09 Keep mulch moist by daily application of water (if necessary), for a minimum of ten days or until the seeds in the mulch have germinated and rooted in soil.
10 Any disturbed area shall be at least hydro-mulched after being brought back to final grade. All debris and rocks shall be removed prior to spraying.
11 Re-seed after 10 days if no stand after 3 days. No bare batch more than 3” in any direction is allowed.

3.3 MAINTENANCE

A. The hydro mulch seeding shall be adequately watered until established. Any areas damaged by erosion or areas that do not have an acceptable turfing shall be redone to the satisfaction of the Architect.

B. Maintenance Period:
01 Maintain new seeding until substantial completion.
02 Reseed during this period.
03 Repair damage to other plants or lawns during maintenance period.
04 Seed, water, and mow as specified.

C. Ten days before end of maintenance period, notify Architect for inspection.

D. A full stand of grass is required for substantial completion. Mowing, edging watering, weeding and maintaining shall be the responsibility of the contractor prior to substantial completion. Temporary above-ground irrigation system is at

Contractor's discretion. Mowing and edging shall be done weekly with clean-up.

3.4 CLEANING

A. Remove barriers and signs from project site at termination of establishment period.

END OF SECTION

SECTION 32 92 23

SOLID SODDING

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

A. Refer to Section AB - Instructions to Proposers and Section AF – Subcontractor and Manufacturer Prequalification for substitutions.

B. Scope of Work:
   01 Provide solid sodding adjacent to all concrete work, including building, foundations, paving, flatwork, and sidewalks; or as indicated on the drawings.

C. Related Work:
   01 Section 31 15 00 – Site Clearing and Earthwork
   02 Section 31 22 19 – Finish Grading
   03 Section 32 92 13 – Hydro Mulching
   04 Section 32 93 00 – Landscaping

1.2 SUBMITTALS

A. Provide all submittals in accordance with Section 01 33 00 – Submittal Procedures.

B. Certificates: Supplier's certification shall state that all sod meets State, Federal Department of Agriculture and specification requirements, and is free from hazardous insects or apparent diseases.

1.3 QUALITY ASSURANCE

A. Source Quality Control: Producer's test for purity and germination of sod dated within nine months of sowing.

B. Comply with recommendations of “Official Method of Analysis” - Association of Official Analytical Chemists.

C. Restrict foot and vehicular traffic from sodded areas after planting to end of established period.

D. Immediately after sodding, erect barricades and warning signs as required to protect seeded areas from traffic until grass lawn is established.

1.4 WARRANTY

A. Provisional Acceptance: Sodding reviewed as being in accordance with specifications.

B. Guarantee Period: Guarantee stand of grass until substantial completion.

1.5 CONTRACTOR'S MAINTENANCE

A. The Contractor's maintenance of new sodding / hydro-mulch areas shall consist of watering, cultivating, weeding, mowing, edging and fertilizing every week, and furnishing and applying such sprays and invigorates necessary to keep sodding / hydro-mulch free from insects and diseases, and in thriving condition and mowing of entire site until substantial completion or until the planting density / requirements have been met, whichever is later.

B. Protect sodding at all times against damage of all kinds for the duration of Maintenance Period. Any plants damaged or injured, because sufficient protection was not provided, shall be treated or replaced by the Contractor, as directed by Owner, at no additional cost to the Owner.

C. See following maintenance frequency schedule.

MAINTENANCE FREQUENCY SCHEDULE

Mowing, Edging, Trimming, Litter Clean Up, and Irrigation Monitoring:

Month	Number of Visits Per Month (minimum)
January	2
February	2
March	4 (Start up irrigation system)
April	4
May	5
June	4
July	5
August	5
September	5
October	3
November	2 (Shut down irrigation system)
December	2

01 Top Dress Fertilizer: Thirty (30) days after seeding and/or sodding.
02 Weeding and Weed Control: As required at each visit.
03 Reseeding and/or Re-sodding: As required upon notice.

1.6 FINAL ACCEPTANCE

A. Work under this section will be accepted by the Owner upon satisfactory completion of all work, including maintenance, but excluding replacement of plant material under the warranty period. Upon final acceptance, the Owner will assume responsibility for maintenance of the work.

B. Grass / Sodding shall be sound, healthy and vigorous. All areas shall be free from disease, insect pests, eggs, or larvae and shall have healthy, well developed root systems. They shall be free from physical damage or adverse conditions that would prevent thriving growth.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Sod:

01 Certified sod shall be dense, well rooted St. Augustine, except at practice field, which shall be common Bermuda, approximately 2 inches high, grown in the general locality where it is to be used. It shall be free of debris, weeds, or undesirable grasses, and shall be subject to inspection and approval at the place of growth or upon delivery to the site. The sod shall be cut in uniform strips approximately 18” x 36”, but not longer than it is convenient for handling and transplanting.

02 Sod shall be kept moist for protection and to facilitate handling. Sod shall be rolled in tight rolls or laid on boards or planks and lifted and transported to storage piles or carried to the point of installation without breaking. In all cases, sod must be lifted and loaded or unloaded by hand. Dumping from vehicles will not be permitted.

03 Sod shall be laid immediately. In no case shall sod remain in storage piles longer than three (3) days and shall be protected from wind and rain during such period.

04 Apply weed elimination pre-emergent before laying/setting sod. Pre-emergent shall be Ronstar-G. Pre-emergent shall be applied before laying of sod at a rate of 100-200 lbs per acre.

B. Root Zone (at practice field):

01 12-inch thick

02 Consists of 70% coarse sand, 0.5 mm screened, 10% clay, 20% silt.

03 Bank sand shall not be used.

PART 3 - EXECUTION

3.1 INSPECTION

A. Check that preceding work affecting ground surface is completed.

B. Verify that soil is within allowable range of moisture content.

C. Soil is to be free of weeds and foreign material immediately before seeding.

3.2 APPLICATION

A. All areas covered with fill and identified to be sodded as indicated on the drawings shall have all soil area prepared and sodded.

B. Sodded areas shall be soil conditioned, fertilized and contours brought to a finished grade as indicated on drawings before sod is placed. Conditioned soil that has been compacted shall be again conditioned in such a manner as to present a finely pulverized, smooth and even bed of not less than 2 inches of topsoil, existing or imported as required to achieve this condition.

C. The sod shall be laid in sections with closely abutting joints. Any openings that may occur shall be neatly plugged with sod. The sod shall then be thoroughly tamped and watered.

D. On all slopes steeper than 1 foot vertical to four 4 feet horizontal, the sod shall be staked or pegged with pieces of plasterers lath or stakes as needed by the nature of the soil and steepness of slope, from 18 inches to 24 inches apart along the longitudinal axis of the sod strip.

E. Stakes shall be placed near the top edge of the sod strip and shall be driven approximately plumb through the sod to be almost flush with the surface of the sod. As may be ordered by the Architect, sod in a total width of approximately 3 feet shall be placed around flow lines, and other locations designated by the Architect.

F. Before laying the sod, excess soil shall be removed so that the finished surface of the sodded areas will be flush with adjacent graded field surfaces. Any excavation necessary will be considered as part of the sodding operations, and no separate payment will be made other than the payment for sodding.

G. All applications of sod shall be followed with sanding of seams (joints) until no grooves/divots exist.

3.3 MAINTENANCE

A. All sodded areas shall be adequately watered until established. Any areas damaged by erosion or areas that do not have an acceptable turfing shall be resodded to the satisfaction of the Architect.

B. Lawn areas shall be protected against damage from the time work is started until the date of acceptance by the Architect. The moving of equipment or materials over lawn areas shall be on planks if necessary.

3.4 ACCEPTANCE

A. The work of fertilizing and sodding will be accepted by the Architect upon completion of the same, if it complies with the specifications or upon substantial completion of the entire project, whichever is later.

3.5 INSPECTION

A. Make request for inspection prior to sodding and after areas have been sodded.

B. Submit requests for inspections to Architect and Owner at least two (2) days prior to anticipated inspection date.

END OF SECTION