Milam County Annex
Rehabilitation
Cameron, Texas

ARCHITEXAS Project No. 1944
May 19, 2020
Issued for Proposal

Owner
Milam County
102 S. Fannin Street
Cameron, TX 76520

Architect
ARCHITEXAS
Architecture, Planning and Historic Preservation, Inc.
2900 S. Congress, Suite 200
Austin, TX 78704
512-444-4220

MEP Engineers
APTUS Engineering
1919 1st Street, Bldg. B
Austin, TX 78704
512-872-5059
Milam County Annex
Rehabilitation
Cameron, Texas

THE ARCHITECT’S SEAL AND SIGNATURE ON THE DRAWINGS AND PROJECT MANUAL CERTIFIES THAT THE DOCUMENTS WERE DONE BY THE ARCHITECT OR UNDER HIS RESPONSIBLE SUPERVISION FOR THIS PROJECT.

Stanley O. Graves, Registered Architect
May 19, 2020

Seal

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## APPENDIX

Detailed Door Inventory


Mechanical Compliance Certificate (COMcheck), prepared by Aptus Engineering

Interior Lighting Compliance Certificate (COMcheck), prepared by Aptus Engineering

AIA Document A101-2017 Standard Form of Agreement Between Owner and Contractor

AIA Document A201-2017 General Conditions of the Contract for Construction

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REQUEST FOR COMPETITIVE SEALED PROPOSALS (Advertisement)

Milam County requests competitive sealed proposals for construction of:
Project No. 1944
Milam County Annex Rehabilitation

100% Performance and Payment Bonds required.
5% Proposal Guaranty required.

PROPOSAL DEADLINE: 3:00 PM. Milam County time, on June 19, 2020, at Milam County Auditor’s Office, 103 West Main St., Suite A, Cameron, Texas 76520, (254) 697-7026. Proposals will thereafter be publicly opened 10:00 AM, on June 23, 2020, and the names of the offerors and any monetary proposals made by the offerors will be read aloud.

Proposal Instructions, copies of drawings, specifications and contract documents, addenda (if any) and other documents related to this Request for Proposals will be available at the location indicated below. They may be viewed electronically on the milamcounty.net website – Public Notices/Bid Proposals page under Milam County Annex Plans; complete or partial sets can be purchased.

Request and pick up printed documents at:

Request and pick up printed documents at:
4015 S. Texas Avenue
Bryan, Texas 77802
(979) 260-5902
Email: BVCAPlanRoom@gmail.com

Questions or concerns regarding this Request for Proposals must be directed to: Stanley Graves, FAIA, or Susan Frocheur, ARCHITEXAS, by phone at: (512) 444-4220, or by email at: sgraves@architexas.com or sfrocheur@architexas.com.

PRE-PROPOSAL CONFERENCE: 10:00 AM. Milam County time, on June 4, 2020 at: 806. N. Crockett Avenue, Cameron, Texas 76520. Milam County may consider an Offeror’s attendance of the pre-proposal conference in its determination of best value of each Proposal submitted.

Milam County reserves the right to reject any and all proposals.
Milam County ("MC") requests competitive sealed proposals for a Contractor to perform the construction of the Work described below in connection with MC’s “Milam County Annex Rehabilitation” (the “Project”). MC is interested in receiving proposals from General Contractors with experience in successfully completing projects that are similar in scope, size and complexity to the Work and meeting any specialized requirements set forth below.

1. PROJECT

1.1 Scope of Work. The selected Offeror must furnish all labor, materials and equipment required for the construction of the following improvements (the “Work”):

Exterior and Interior Rehabilitation

To be constructed at the following location (“Project Site”):

Milam County Annex, 806 N Crockett Avenue, Cameron, Texas 76520

1.2 Estimated Project Budget: $3.5 Million

1.3 Minimum Qualifications. Because of the nature of the Work, the selected Offeror must meet the following qualifications and/or must have any licenses or certifications specified below (collectively, the “Minimum Qualifications”):

Offerors must be properly licensed under the laws governing their respective trades and be able to obtain insurance and bonds required for the Work.

2. REQUEST FOR PROPOSALS

2.1 This Request for Competitive Sealed Proposals ("Request for Proposals") consists of the following documents:

- Advertisement for Request for Proposals;
- Instructions to Offerors;
- Proposal Form;
- Any Contract Documents referenced in this Request for Proposals;
- Any addenda to this Request for Proposals issued by MC or Architect;
- Attached forms; and
- Proposal Bond Form.

3. DRAWINGS, SPECIFICATIONS, CONTRACT DOCUMENTS AND ADDENDA

3.1 Copies of Drawings, Specifications, Contract Documents, and Addenda (if any) and other documents related to this Request for Proposals, are available for purchase at BVCA Plan Room at the location indicated in Section 3.2 below. The Drawings, Specifications and Addenda (if any) are available for viewing on the milamcounty.net website – Public Notices/Bid Proposals under Milam County Annex Plans. The documents may also be available for viewing at various local plan rooms.

3.2 Printed copies of Drawings, Specifications, Contract Documents, and Addenda (if any) can be requested and picked up at the following location in accordance with Section 3.1 above:
4. FORMAT FOR PROPOSALS

4.1 Each proposal (“Proposal”) submitted by an offeror (“Offeror”) must contain the following:

- The completed Proposal Form (including the Offeror information in Section D thereof);

- The Proposal Guaranty described in Section 13.

4.2 The Proposal information must be typed or neatly printed on the Proposal Form.

4.3 The Offeror information in Section D of the Proposal Form must be typed or neatly printed on Section D of the Proposal Form or on letter-size (“8½ x 11”) paper if additional sheets are used. If preprinted materials, flyers or other information about the Offeror is used, it should be referenced in the submittal and included as labeled attachments.

4.4 The Proposal Form and other forms included in the Proposal should be stapled or bound together in a binder, so that the pages can be easily opened and laid flat for copying.

4.5 One (1) original of the complete Proposal must be submitted. An original is a Proposal containing the original signature of a person authorized to sign on behalf of the Offeror.

4.6 The Proposal must be submitted in a sealed envelope which states on the outside the following information:

- “Competitive Sealed Proposal for Milam County Annex Rehabilitation”
- Proposal Deadline: 3:00 PM June 19, 2020
- Name and mailing address of the Offeror

5. PLACE FOR SUBMITTING PROPOSALS

5.1 Proposals must be submitted by mail or hand delivery to:

Milam County Auditor’s Office
103 West Main St., Suite A
Cameron, Texas 76520

5.2 Proposals sent by Facsimile (Fax) or Electronic Mail (E-mail) or Proposals submitted to any other address other than the Place for Submitting Proposals described in Section 5.1 above will NOT be accepted.

6. DEADLINE FOR RECEIVING PROPOSALS

6.1 Proposals must be received at the Place for Submitting Proposals described in Section 5 above, no later than 3:00 p.m., Milam County time, on June 19, 2020 (“Proposal Deadline”). The clock used at the Place for Submitting Proposals shall conclusively determine the time that proposals are received.

6.2 Proposals received after the Proposal Deadline will be returned unopened.

6.3 The Proposal Deadline may be extended by Addendum to this Request for Proposals.
7. **PRE-PROPOSAL CONFERENCE**

7.1 A pre-proposal conference will be held at 10:00 AM, Milam County time, on June 4, 2020, at the project site, 806 N. Crockett Avenue, Cameron, Texas 76520.

8. **TIME AND PLACE OF OPENING OF PROPOSALS**

8.1 Proposals which have been timely received will be publicly opened Tuesday, June 23, 2020 at 10:00 AM in the Commissioner’s Courtroom, 1st Floor of the Milam County Courthouse, 102 South Fannin, Cameron, Texas. The names of the Offerors and any monetary proposals made by the Offerors will be read aloud.

9. **METHOD OF SELECTING CONTRACTOR**

9.1 Not later than the 30th day after the date on which Proposals are opened, MC will evaluate and rank each Proposal submitted in relation to the Selection Criteria set out below. MC will select the Offeror that, in the opinion of MC, submits the Proposal that offers the best value for MC based on the Selection Criteria and the weighted value for each Selection Criteria and on MC’s ranking evaluation. The Offeror that offers the best value may or may not be the Offeror that submits the lowest proposal for the cost of construction.

9.2 The Architect will make a recommendation to MC as to the selection ranking of the Offerors. The County will select the Offeror that submits the Proposal that offers the best value for MC and will authorize the negotiation and execution of the contract. If MC is unable to negotiate a satisfactory contract with the selected Offeror, MC shall, formally and in writing, end negotiations with that Offeror and proceed to the next Offeror in the order of the selection ranking until a contract is reached or all proposals are rejected. MC reserves the right to reject any and all proposals.

10. **SELECTION CRITERIA**

10.1 Offerors will be evaluated based on the following selection criteria and weighted value for each criterion (collectively, “Selection Criteria”):

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<td>Construction Cost as Proposed</td>
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<td>Relevant Experience and Past Performance</td>
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<td>Proposed Personnel/Resources</td>
<td>15%</td>
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<td>Financial Condition</td>
<td>5%</td>
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<td>Safety Record</td>
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<td>Offeror's attendance of pre-proposal conference</td>
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11. **QUESTIONS REGARDING THIS REQUEST FOR PROPOSALS**

11.1 Any questions or concerns regarding this Request for Proposals must be directed to the “Contact Persons” as follows:

Stan Graves, FAIA
2900 South Congress Avenue
Suite 200
Austin, Texas 78704
Phone: (512) 444-4220
Fax: (512) 444-4221

Susan Frocheur, RA NCARB
2900 South Congress Avenue
Suite 200
Austin, Texas 78704
Phone: (512) 444-4220
Fax: (512) 444-4221

Milam County Annex
Cameron, Texas
00 00 16-3
Request for Competitive Sealed Proposals
MC specifically requests that Offerors restrict all contact and questions regarding this Request for Proposals to the Contact Persons.

11.2 Questions must be received by the Contact Persons no later than 4 business days prior to the Proposal Deadline.

11.3 If the Contact Persons determine that a response is required to any question received by the Contact Persons, an answer will be provided to such question through an Addendum to this Request for Proposals.

11.4 An effort will be made to provide a copy of all Addenda issued to each Offeror who is on the list of having received a Request for Proposal. However, it is the obligation of each Offeror to make sure prior to submitting a Proposal, that it has received all Addenda in connection with this Request for Proposals. Copies of Addenda issued to this Request for Proposals can be obtained from the Contact Persons as provided in Section 11.1.

11.5 Only those responses to inquiries which are made by formal written Addenda shall be binding. Oral and other interpretations or clarifications will be without legal effect, and shall not be binding on MC or the Architect. The Offeror must acknowledge receipt of all Addenda in its Proposal. However, each Offeror will be bound by the terms of all Addenda, and its Proposal will be construed to include the information contained in the Addenda, whether or not Offeror has received them or acknowledged receipt.

12. WITHDRAWAL OF PROPOSALS

12.1 Prior to the Proposal Deadline, an Offeror may withdraw its Proposal, and may, if it chooses, submit a new Proposal, if the new Proposal is submitted before the expiration of Proposal Deadline. The request for withdrawal of a Proposal must be in writing and signed by an authorized representative of the Offeror.

12.2 After the Proposal Deadline, an Offeror may not withdraw its Proposal for a period of 90 days after Proposal opening, unless withdrawal is required by applicable law or permitted by MC.

12.3 Each Proposal received will be presumed to be accurate and free from error, unless clear and convincing evidence to the contrary is presented.

13. PROPOSAL GUARANTY

13.1 Each Proposal must be accompanied by a Proposal Guaranty in the amount of five percent (5%) of the largest possible total Proposal (i.e. the sum of the Base Proposal and all additive Alternates).

13.2 The Proposal Guaranty shall be in the form of (i) a cashier’s check written on a Bank with one or more branch offices located in Texas, payable to the order of the Milam County (and should be dated no earlier than one month before the deadline for Proposal submission) or (ii) a Proposal Bond in the form included with this Request for Proposals issued by a corporate surety authorized to do business in the State of Texas, that is listed on the U.S. Treasury list of approved sureties.

13.3 The Proposal Guaranty will be held until the selected Offeror has signed the Contract and provided the required insurance and payment and performance bonds and Safety Plan as provided in these instructions.

13.4 Should the selected Offeror fail or refuse to sign the Contract and/or provide the required insurance and payment and performance bonds and Safety Program Manual and Safety Plan as provided in these instructions, then the Offeror’s Proposal Guaranty will be forfeited to Milam County as liquidated damages and not as a penalty.
14. **SUBSTITUTION OF MATERIALS**

14.1 Offerors may request a substitution of materials or equipment specified in the Contract Documents. However, any such request must be submitted in writing to the Contact Persons five days before the Proposal Deadline. If the Architect approves the substitution, it will respond by Addendum as described in Section 11. A failure to respond will constitute a denial of the request. Sufficient information should accompany the request to enable the Architect to promptly render a decision on a proposed substitution of materials or equipment.

15. **POST-PROPOSAL INFORMATION**

15.1 By submitting a Proposal, the Offeror agrees to provide evidence upon request of MC that the Offeror satisfies the Minimum Qualifications set out in Section 1.3 above.

15.2 By submitting a Proposal, the Offeror agrees to promptly furnish any additional information required by MC in order to evaluate the Proposals.

16. **REJECTION OF PROPOSALS**

16.1 Proposals may be rejected if they do not contain the information required by this Request for Proposals or if they do not contain the information stated in Section 4.1 hereof.

16.2 Proposals may be rejected if the Minimum Qualifications specified in Section 1.3 above are not met.

16.3 Proposals may be rejected if they contain qualifications, conditions to performance, or if they are incomplete, or for any other reason authorized by law.

16.4 MC reserves the right to waive any minor informality or irregularity in the Proposal or Proposal process, and to reject any and all Proposals.

17. **BOND AND INSURANCE REQUIREMENTS**

17.1 Insurance meeting the requirements set out in the Supplementary Conditions must be furnished by the selected Offeror within 5 days after the Contract is signed by the Offeror.

17.2 If the Contract amount is over $25,000, the selected Offeror must provide payment and performance bonds each in the amount of 100% of the Contract Price within 5 days after the Contract is signed by the Offeror. Bonds must be provided by a Treasury-listed corporate Surety authorized to do business in the State of Texas.

17.3 The Offeror’s attention is directed to Article 11 of the Supplementary Conditions which expressly sets out the Worker’s Compensation Insurance requirements for the Project. The Contractor and each subcontractor must maintain Worker’s Compensation Insurance coverage as required in Subsection 10.4 and the Contractor is required to provide a certificate of coverage for each subcontractor prior to that subcontractor beginning Work on the Project Site, showing that coverage is being provided for all of its employees for the duration of the Work. Subsection 10.4 is incorporated herein for all purposes.

18. **SAFETY PLAN REQUIREMENTS**

18.1 The selected Offeror must submit a Safety Plan for the Project meeting the requirements set out in the General Conditions not later than 5 days after the Offeror signs the Contract.

19. **PREVAILING WAGE RATES**

19.1 The Contractor and each Subcontractor who performs work under the Contract must pay, at a minimum, the applicable prevailing wage rates to a worker employed by it in the performance of the Work.
20. EXAMINATION OF SITE AND CONTRACT DOCUMENTS

20.1 Each Offeror is required to visit the Project Site and to fully acquaint itself with the conditions and limitations as they exist at the Project Site, including the effect that weather conditions may have on the Project Site. Each Offeror shall also fully acquaint itself with the existing and anticipated sources and supplies of labor and materials, and shall also thoroughly examine the Contract Documents. Failure of the Offeror to visit the Project Site and acquaint itself with the conditions of the Work and the Contract Documents shall in no way relieve the Offeror from any obligations with respect to its Proposal.

21. PUBLIC INFORMATION

21.1 MC considers all information, documentation and other materials requested to be submitted in response to this solicitation to be of a non-confidential and/or non-proprietary nature and therefore shall be subject to public disclosure under the Texas Public Information Act (TEX. GOV’T CODE, Chapter 552.001, et seq.) after a contract is awarded.

21.2 Offerors are hereby notified that MC strictly adheres to all statutes, court decisions, and opinions of the Texas Attorney General with respect to disclosure of public information.

22. DEADLINE FOR SIGNING CONTRACT AND MC’S RIGHTS IF DELAY

22.1 The timely completion of this Project is essential. MC has the right to consider negotiations with the selected Offeror for the Contract incomplete until and unless the Contract is signed and the bonds, insurance and Safety Plan are submitted in accordance with the following deadlines. In order to avoid unnecessary delays in the Project, the selected Offeror must:

   .1 sign the Contract no later than 10 days after the selected Offeror has been notified that it is the successful Offeror, and

   .2 provide its Safety Plan for the Project and provide all required bonds and insurance within 5 days after the selected Offeror signs the Contract.

22.2 If the selected Offeror fails to meet one or more of these deadlines, then in addition to any and all other rights and remedies to which MC is entitled, MC shall have the right to:

   .1 terminate its negotiations with the selected Offeror and begin negotiations with the next ranked Offeror; or

   .2 proceed with the Contract with selected Offeror, but treat each day beyond the 10 day deadline in which the Contract is unsigned by the Offeror, and/or each day beyond the 5 day deadline in which one or more of the required documents has not been submitted, as a day of unexcused delay under the Contract.

23. WAIVER OF CLAIMS

24. CONFLICT OF INTEREST QUESTIONNAIRE

24.1 Offeror is advised to determine if it is required under Chapter 176 of the Texas Local Government Code to file a completed conflict of interest questionnaire with MC. If Offeror is required by law to complete the questionnaire, the Conflict of Interest Questionnaire (Form CIQ) should be completed and submitted with the proposal.

END OF SECTION
To: Milam County
   Cameron, Texas

Re: RFP for Milam County Rehabilitation, Architexas Project No. 1944

The undersigned offeror ("Offeror") submits this Proposal for the performance of the Work of construction, alteration or repair (the "Work") described as follows:

**Milam County Rehabilitation, Architexas Project No. 1944**

The undersigned Offeror has carefully examined and considered the Project Site and relevant conditions and circumstances for the Work, information and requirements set out in the Request for Proposals, the Drawings and Specifications, and the requirements of the proposed Contract Documents, including the Agreement For Construction, the General Conditions and the Notice of Prevailing Wage Rates, in making this Proposal. Capitalized terms used but not otherwise defined in this Proposal Form shall have the same meanings as designated in the Request for Proposals.

A. **Proposal Terms**

Based on the foregoing, the undersigned Offeror hereby offers and proposes to perform the Work, in accordance with the Contract Documents, for the Contract Amount based on the Pricing Schedule set forth below, within the Substantial Completion Date proposed below.

1. **Pricing Schedule**

Express in words and numbers.

Base Proposal _______________________

____________________________________ ($__________)

2. **Substantial Completion Date**

Offeror will achieve Substantial Completion of the Work within the following calendar days after a Notice to Proceed is issued:

______________________________________ Days (_______________).

3. **Liquidated Damages**

Milam County shall have the right under the Contract to assess liquidated damages in the amount of $200 per day for each and every calendar day beyond the Substantial Completion Date set out in the Contract that the Work fails to be substantially complete.

4. **Overhead and Profit for Changes in the Work**: The following percentages will be used to determine the amount of overhead and profit to be added to Offeror's costs for changes in the Work ordered by the Owner:

   A. For Work performed by Contractor's own forces:

      Overhead: ________ percent  Profit: ________ percent

   B. For work performed by a subcontractor and supervised by Contractor:
5. **Alternates:** Bidder proposes the following alternate pricing:

   A. Alternate No. 1: Repave East Parking Lot $_____________ Lump Sum
   
   B. Alternate No. 2: Repave West Parking Lot $_____________ Lump Sum
   
   C. Alternate No. 3: Provide ADA Parking Adjacent to North Entry $_____________ Lump Sum
   
   D. Alternate No. 4: Replace Existing Roof Mounted Outdoor Air Handling Unit $_____________ Lump Sum
   
   E. Alternate No. 5: Provide 2nd Chiller $_____________ Lump Sum
   
   F. Alternate No. 6: Provide Lightning Protection System $_____________ Lump Sum
   
   G. Alternate No. 7: Replace Gyp. Board Ceilings is Kitchen Area $_____________ Lump Sum
   
   H. Alternate No. 8: Selective Exterior Work at Convent $_____________ Lump Sum
   
   I. Alternate No. 9: Asbestos Abatement at Convent $_____________ Lump Sum

B. **Enclosed Documents**

   The following are enclosed with this completed Proposal:

   1. A Proposal Guaranty in the amount of 5% of the maximum total proposed Contract Amount (i.e. the sum of the Base Proposal and all additive Alternates) in the form of either a cashier's check payable to Milam County or a Proposal Bond on the required Proposal Bond Form.

C. **Offeror Representations and Certifications**

   By signing and submitting this Proposal, the undersigned Offeror and person signing on its behalf certifies and represents to Milam County:

   1. (i) Offeror has not offered, conferred or agreed to confer any pecuniary benefit or other thing of value as consideration for the recipient's decision, opinion, recommendation, vote or other exercise of discretion concerning this Proposal;

   (ii) Offeror has not violated any state, federal or local law, regulation or ordinance relating to bribery, improper influence, collusion or the like, and Offeror will not in the future offer, confer, or agree to confer any pecuniary benefit or other thing of value to any officer, Trustee, agent or employee of Milam County in return for the person's having exercised official discretion, power or duty with respect to this Proposal.

   2. All information contained in this Proposal, including the information provided in Section D below is, to the best of the undersigned's knowledge and belief, true, complete and accurate.

   3. **Offeror waives any claim it has or may have against the Architect, its consulting**

4. Offeror has received the following Addenda to the Request for Proposals, but agrees and understands that it will be responsible for performing the Work in accordance with all terms and conditions in all Addenda issued in connection with the Request for Proposals, and that its Proposal will be construed to include all requirements of all such Addenda, whether or not identified below:

Addenda No. __________________________________________
Addenda No. __________________________________________
Addenda No. __________________________________________
Addenda No. __________________________________________
Addenda No. __________________________________________

5. Offeror (or its subcontractors/suppliers, as applicable) meets all of the Minimum Qualifications specified in Section 1.3 of the Request for Proposals.

D. Offeror Information

All of the following information must be provided by Offeror. Use additional sheets if necessary. If additional sheets are used, clearly indicate the question number to which you are responding. Responses must be typed or printed neatly. Illegible responses will not be considered. The Offeror is also sometimes hereinafter referred to below as the "organization" or the "company."

1. General Information

1.1 Name of Offeror: ________________________________

1.2 Name of Project: ________________________________

1.3 Address of office from which Offeror will conduct the Work:

____________________________________________________

1.4 Offeror’s Contact Person for this Work:
Name: ____________________________________________
Address: __________________________________________
Phone: ____________________________________________
Fax.: _____________________________________________

1.5 Offeror’s Home Office Address: ______________________

____________________________________________________
1.6 Does any relationship exist between the Offeror, its officers, principals, or employees and any of Milam County’s officers, or employees?

☐ YES ☐ NO

If yes, please explain. __________________________________________________________

1.7 Principal Business:

_____ General Construction       _____ Mechanical/Electrical/Plumbing

_____ Demolition                _____ Interior Finish-out

_____ Other ____________________________

(Please specify)

1.8 Licensing/Certifications for Prime Contractors:

List trade categories in which your organization is legally qualified to do business in Cameron, Texas, and indicate registration or license numbers, as applicable.

____________________________________________________________________________

____________________________________________________________________________

1.9 Minimum Qualifications:

To the extent not otherwise described in Section 1.8 above, describe your organization’s compliance with all Minimum Qualifications set forth in Section 1.3 of the Request for Proposals and include all necessary attachments evidencing same.

____________________________________________________________________________

____________________________________________________________________________

1.10 Work to be Performed on this Project by Offeror’s Own Forces:

List the general categories of work that your organization intends to perform on this Project using its own forces.

____________________________________________________________________________

____________________________________________________________________________

2. Organization

2.1 How many years has your organization been in business as a contractor?

______ Years

2.2 How many years has your organization been in business under its present business name?

______ Years

2.3 Under what other or former names has your organization operated?

____________________________________________________________________________

Name__________________________________________      Years______

Milam County Annex 00 00 20-4 Proposal Form
Cameron, Texas
2.4 If your organization is a corporation, answer the following:
   2.4.1 Date of incorporation: _________________________________  
   2.4.2 State of incorporation: ________________________________  
   2.4.3 President’s name: _________________________________

2.5 If your organization is a limited liability company, answer the following:
   2.5.1 Date of organization: _________________________________  
   2.5.2 State of organization: ________________________________  
   2.5.3 President’s, Manager’s or Managing Member’s name:_________

2.6 If your organization is a partnership, answer the following:
   2.6.1 Date of organization: _________________________________  
   2.6.2 Type of Partnership: _________________________________  
   2.6.3 Name(s) of general partner(s):
   ________________________________________________________
   ________________________________________________________
   ________________________________________________________

2.7 If your organization is individually owned, answer the following:
   2.7.1 Date of organization: _________________________________  
   2.7.2 Name of owner: _________________________________

2.8 For all business entities other than publicly held corporations, please provide the following:
   2.8.1 Award to Nonresident Bidders
   Is your business organized under the laws of the State of Texas?  
   ☐ YES ☐ NO
   What is the location of your principal place of business?  
   ________________________________________________________

   Proposals from nonresident contractors shall be evaluated according to Tex. Gov.  
   Code § 2252.002.

2.9 Is your company currently for sale or involved in any transaction to expand or to  
become acquired by another business entity? If yes, please explain the impact  
both in organizational and directional terms.

3. Relevant Experience

3.1 On the attached Table A, list all projects your company has in progress and  
provide all additional information requested.

3.2 On the attached Table B, list all county government projects that your company  
has completed in the past five (5) years, and provide all additional information  
requested.
3.3 On the attached Table C, list all non-county government projects your company has completed in the past five (5) years and provide all additional information requested.

4. Past Performance

Claims and Suits. (If the answer to any of the questions below is yes, please attach details not to exceed one page for each of the following questions.)

4.1 Has your organization ever failed to complete any work awarded to it? (If yes, attach details.)

☐ YES ☐ NO

4.2 Are there any judgments, claims, arbitration proceedings or suits (past, pending or outstanding) against your organization or its officers arising out of or in connection with your company's performance under a contract for construction management and/or construction services? (If yes, attach details, including a description of how such suits or claims were resolved, if applicable.)

☐ YES ☐ NO

4.3 Has your organization filed any law suits or requested arbitration with regard to construction contracts within the last five years? (If yes, attach details.)

☐ YES ☐ NO

4.4 Has your organization been assessed liquidated damages on a project in the last five (5) years? (If yes, attach details.)

☐ YES ☐ NO

4.5 Within the last five years, has any officer or principal of your organization ever been an officer or principal of another organization when it failed to complete a construction contract? (If yes, attach details.)

☐ YES ☐ NO

4.6 Trade References. Provide the following information for three trade references:

Company name: ____________________ Contact person: _____________
Address: __________________________ Telephone: _________________
________________________

Company name: ____________________ Contact person: _____________
Address: __________________________ Telephone: _________________
________________________

Company name: ____________________ Contact person: _____________
Address: __________________________ Telephone: _________________
5. **Personnel**

5.1 On the attached Table D, list the names of the key individuals [Project Manager, Construction Superintendent, Assistant Superintendent (if applicable)] of your organization which are proposed to be assigned to this Project and provide the additional information requested on Table D. For each key individual listed on Table D, provide a resume (not to exceed 2 pages) which includes the key individual’s construction experience and a description of his/her qualifications and experience relative to the Project.

6. **Financial**

6.1 Bank References. Provide the following information for one Bank reference:

Company name: ________________  Contact person: ________________
Address: ________________  Telephone: ________________

6.2 Surety:

6.2.1 Name of your organization’s bonding company:

__________________________________________

6.2.2 Name, address and phone number of agent:

Company name: ________________  Contact person: ________________
Address: ________________  Telephone: ________________
__________________________________________

6.3 Financial Statement. All statements submitted will be used exclusively by Milam County in the evaluation of the award of the contract on the underlying project. Statements will be kept confidential to the extent permitted by law.

6.3.1 Attach an audited or reviewed financial statement, including an independent auditor’s report, balance sheet, income statement, and the related notes to the financial statement. Financial statements that are more than one year old are not acceptable.

6.3.2 Name and address of firm preparing attached financial statement, and date thereof:

Company name: ________________  Contact person: ________________
Address: ________________  Telephone: ________________
__________________________________________

6.3.3 If financial statements for an affiliate of the organization are also attached, will such organization act as guarantor of the contract for construction?

☐ YES  ☐ NO

6.4 State whether your company is currently in default on any loan agreement or financing agreement with any bank, financial institution, or other entity? If yes, specify date(s), details, circumstances, and prospects for resolution.

6.5 State whether your company is currently contemplating or has pending
7. Safety Record

7.1 Please provide the following information in connection with your organization's safety record:

7.1.1 A one page maximum discussion of your company's approach to maintaining a safe work environment.

7.1.2 A one page maximum discussion of your company's history of worker's compensation claims or other claims relating to project safety for the past 5 years.

8. Attendance of Pre-Proposal Conference

8.1 As an offeror, did your company attend the pre-proposal conference?

☐ YES ☐ NO

Attendee(s):

____________________________________________________

____________________________________________________

____________________________________________________

Executed as of this _____ day of _____________________, 20____.

Offeror: ____________________________________________

Address: ____________________________________________

City, State, Zip Code: ________________________________

By: ________________________________________________

Name: ______________________________________________

Title: ______________________________________________

Date: ______________________________________________

Telephone: __________________________________________
<table>
<thead>
<tr>
<th>Project Name</th>
<th>Owner</th>
<th>Owner’s Contact Person and Phone Number</th>
<th>Architect</th>
<th>Architect’s Contact Person and Phone Number</th>
<th>Contract Amount</th>
<th>Percent Complete</th>
<th>Scheduled Completion Date</th>
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</tbody>
</table>

Total Value of All Projects in Progress: $______________
Table B  All county government projects completed in the past 5 years.

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Owner</th>
<th>Owner’s Contact Person and Phone Number</th>
<th>Architect</th>
<th>Architect’s Contact Person and Phone Number</th>
<th>Original Contract Amount</th>
<th>Total Change Order Amount</th>
<th>Final Contract Amount</th>
<th>Date of Completion</th>
<th>% of work completed with Own Forces</th>
<th>Liquidated Damages (Yes or No)</th>
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<tbody>
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</table>

Total Value of All County Projects Completed in the Past 5 Years: $______
### Table C  All Non-County projects completed in the past 5 years.

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Owner</th>
<th>Owner’s Contact Person and Phone Number</th>
<th>Architect</th>
<th>Architect’s Contact Person and Phone Number</th>
<th>Original Contract Amount</th>
<th>Total Change Order Amount</th>
<th>Final Contract Amount</th>
<th>Date of Completion</th>
<th>% of work completed with Own Forces</th>
<th>Liquidated Damages (Yes or No)</th>
</tr>
</thead>
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</tbody>
</table>

Total Value of All Non-County Projects Completed in the Past 5 Years: $________________
### Table D  Personnel

<table>
<thead>
<tr>
<th>Key Individuals</th>
<th>Number of years with this Company</th>
<th>Commitment for duration of the Project (Yes or No)</th>
<th>Number of county projects this team of key individuals has completed together: __________</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Manager:</td>
<td></td>
<td></td>
<td>Number of non-county projects this team of key individuals has completed together: __________</td>
</tr>
<tr>
<td>[Name]</td>
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<tr>
<td>Construction Superintendent:</td>
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<tr>
<td>[Name]</td>
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<tr>
<td>Assistant Superintendent:</td>
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<tr>
<td>[Name]</td>
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</tbody>
</table>

List below the names of all county and non-county projects that at least two of the key individuals listed above have worked on together within the past five years:

_____________________________________________________________________________________________________
_____________________________________________________________________________________________________
_____________________________________________________________________________________________________
_____________________________________________________________________________________________________
_____________________________________________________________________________________________________.

(Attach one additional page if needed)
SECTION 00 00 30

PROPOSAL BOND

KNOW ALL BY THESE PRESENTS: that the undersigned Principal and Surety are firmly bound to Milam County ("MC") in the principal sum of

________________________________________________________

________________________________________________________

Dollars ($_______________________).

Now the condition of this bond is this: that, whereas the undersigned principal has submitted to MC a proposal to enter into a certain contract whereunder principal undertakes to perform the following-described work of construction, alteration or repair: Milam County Annex Rehabilitation

NOW, THEREFORE, if the principal shall, within ten (10) days following acceptance by Milam County of such proposal and award by said County to said principal of said contract, execute and return such further contract documents as may be required by the terms of the proposal accepted, and within five (5) days after execution of such contract documents, deliver its safety plan for the Project, and the bonds and insurance documents, as required by the terms of the proposal accepted, then this obligation shall be null and void, otherwise it shall remain in full force and the amount hereof shall be paid to and retained by Milam County as liquidated damages for principal’s failure to do so.

Principal: ____________________________________________

By: ________________________________________________

Title: _____________________ Date: ________________

Surety: ____________________________________________

By: ________________________________________________

Title: _____________________ Date: ________________
"General Decision Number: TX20200214 01/03/2020

Superseded General Decision Number: TX20190214

State: Texas

Construction Type: Building

Counties: Leon and Milam Counties in Texas.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Under Executive Order (EO) 13658, an hourly minimum wage of $10.80 for calendar year 2020 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least $10.80 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2020. If this contract is covered by the EO and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must pay workers in that classification at least the wage rate determined through the conformance process set forth in 29 CFR 5.5(a)(1)(ii) (or the EO minimum wage rate, if it is higher than the conformed wage rate). The EO minimum wage rate will be adjusted annually. Please note that this EO applies to the above-mentioned types of contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but it does not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60). Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number       Publication Date
                        000040-1 01/03/2020

ASBE0021-006 06/01/2016

LEON COUNTY

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Milam County Annex
Cameron, Texas
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<th>Industry and Job Title</th>
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<td>Ironworkers:</td>
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<td>Reinforcing &amp; structural</td>
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<td>IRONWORKER, STRUCTURAL AND REINFORCING</td>
<td>$22.15</td>
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<td>LAB00154-002 05/01/2008</td>
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<td>Laborers: (Mason Tender - Cement/Concrete)</td>
<td>$12.98</td>
<td>3.49</td>
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Milam County Annex     00 00 40 - 2
Cameron, Texas
Prevailing Wage Rates
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<th>Rates</th>
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<tr>
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<td>$14.53  3.49</td>
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<tr>
<td>* PLUM0068-002 10/01/2019</td>
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<td>SUTX2009-101 04/20/2009</td>
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<td>BRICKLAYER</td>
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<td>CARPENTER, Includes Acoustical Ceiling Installation, Batt Insulation, and Metal Stud Installation (Excludes Drywall Hanging, and Form Work)</td>
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<tr>
<td>CEMENT MASON/CONCRETE FINISHER</td>
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<td>DRYWALL HANGER</td>
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<td>LABORER: Common or General</td>
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<td>LABORER: Landscape &amp; Irrigation</td>
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<td>LABORER: Mason Tender - Brick - Brick</td>
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<td>LABORER: Mortar Mixer</td>
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<tr>
<td>OPERATOR: Backhoe/Excavator/Trackhoe</td>
<td>$14.67  0.47</td>
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<tr>
<td>OPERATOR: Bulldozer</td>
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OPERATOR: Crane.................$ 21.33 0.00
OPERATOR: Forklift..............$ 14.58 0.00
OPERATOR: Loader (Front End)....$ 10.54 0.00
PAINTER: Brush, Roller and
Spray............................$ 11.75 0.00
ROOFER...........................$ 13.64 1.80
SHEET METAL WORKER...........$ 17.00 0.00
TILE SETTER......................$ 15.00 0.00
TRUCK DRIVER.....................$ 10.68 0.34

WELDERS - Receive rate prescribed for craft performing
operation to which welding is incidental.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave
for Federal Contractors applies to all contracts subject to the
Davis-Bacon Act for which the contract is awarded (and any
solicitation was issued) on or after January 1, 2017. If this
contract is covered by the EO, the contractor must provide
employees with 1 hour of paid sick leave for every 30 hours
they work, up to 56 hours of paid sick leave each year.
Employees must be permitted to use paid sick leave for their
own illness, injury or other health-related needs, including
preventive care; to assist a family member (or person who is
like family to the employee) who is ill, injured, or has other
health-related needs, including preventive care; or for reasons
resulting from, or to assist a family member (or person who is
like family to the employee) who is a victim of, domestic
violence, sexual assault, or stalking. Additional information
on contractor requirements and worker protections under the EO
is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within
the scope of the classifications listed may be added after
award only as provided in the labor standards contract clauses
(29CFR 5.5 (a) (1) (ii)).
The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers
Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

------------------------------------------------------------------------------------------------------------------------------

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an
interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator  
U.S. Department of Labor  
200 Constitution Avenue, N.W.  
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board  
U.S. Department of Labor  
200 Constitution Avenue, N.W.  
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

================================================================
END OF GENERAL DECISION
"
KNOW ALL MEN BE THESE PRESENTS: that

________________________________________________________
(Name of Contractor or Company)

________________________________________________________
(Address)

a __________________________ hereinafter called Principal, and  
(Corporation/Partnership)  (Name of Surety Company)

hereinafter called Surety, are held and firmly bound unto Milam County, Texas
(Name of recipient)

102 S Fannin Avenue, Cameron, Texas 76520
(Recipient’s Address)

hereinafter called OWNER, in the penal sum of $________________________________________

in lawful money of the United States, for the payment of which sum well and truly to be made we bind  
ourselves, successors, and assignees, jointly and severally, firmly in these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered into a certain  
contract with the OWNER dated the __________________________ day of _______, 2020,  
a copy of which is hereto attached and made a part hereof for the construction of:

Milam County Annex Rehabilitation: Includes the rehabilitation of a former hospital building into  
governmental offices for Milam County. The work will include selective demolition, site work, new and  
repaired mechanical, electrical and plumbing systems, remodeled/rehabilitated/altered interior spaces,  
new entries, commercial kitchen upgrades and other work as required.

NOW THEREFORE, if the Principal shall well, truly and faithfully perform its duties in all the undertakings,  
covenants, terms, conditions, and agreements of said contract during the original term thereof, and any  
extensions thereof which may be granted by the OWNER, with or without notice to the Surety and during  
the one year guaranty period, and if he shall satisfy all claims and demands incurred under such contract,  
and shall fully indemnify and save harmless the OWNER from all costs and damages which it may suffer  
by reason of failure to do so, and shall reimburse and repay the OWNER all outlay and expense which  
the OWNER may incur in making good any default, then this obligation shall be void, otherwise to remain  
in full force and effect.

PROVIDED FURTHER, that the said Surety, for value received hereby stipulates and agrees that no  
change, extension of time, alteration or addition to the terms of the contract or to WORK to be performed  
thereunder or the SPECIFICATIONS accompanying the same shall in any way affect its obligation on this  
BOND, and it does hereby waive notice of any such change, extension of time, alteration or addition to  
the terms of the contract or to the WORK to the SPECIFICATIONS.

PROVIDED, FURTHER, that no final settlement between the OWNER and the CONTRACTOR shall  
abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.
IN WITNESS WHEREOF, this instrument is executed in _____ counterparts, each one of which shall be deemed in original, this the _______ day of ________________________, 2020.

Principal

By ________________________________
Title ______________________________
Address ______________________________
____________________________________
____________________________________
Telephone __________ Fax __________ 
Email Address _______________________

Surety

By ________________________________
Title ______________________________
Address ______________________________
____________________________________
____________________________________
Telephone __________ Fax __________ 
Email Address _______________________

Name and address of Resident Agent of Surety: ______________________________________

____________________________________

NOTE: Date of BOND must not be prior to date of Contract. If CONTRACTOR is Partnership, all partners should execute BOND.

IMPORTANT: Surety companies executing BONDS must appear on the Treasury Department’s most current list (Circular 570 as amended) and be authorized to transact business in the state where the PROJECT is located.

END OF DOCUMENT
PAYMENT BOND

KNOW ALL MEN BE THESE PRESENTS: that

_________________________________________
(Name of Contractor or Company)

_________________________________________
(Address)

a ______________________________ hereinafter called Principal, and ______________________________
(Corporation/Partnership) (Name of Surety Company)

hereinafter called Surety, are held and firmly bound unto Milam County, Texas
(Name of recipient)

102 S Fannin Avenue, Cameron, Texas 76520
(Recipient's Address)

hereinafter called OWNER, in the penal sum of $__________________________

in lawful money of the United States, for the payment of which sum well and truly to be made, we bind
ourselves, successors, and assignees, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered into a certain
contract with the OWNER dated the __________________________ day of ________, 2020, a copy
of which is hereto attached and made a part hereof for the construction of:

Milam County Annex Rehabilitation: Includes the rehabilitation of a former hospital building into
governmental offices for Milam County. The work will include selective demolition, site work, new and
repaired mechanical, electrical and plumbing systems, remodeled/rehabilitated/ altered interior spaces,
new entries, commercial kitchen upgrades and other work as required.

NOW THEREFORE, if the Principal shall promptly make payment to all persons, firms,
SUBCONTRACTORS, and corporations furnishing materials for or performing labor in the prosecution of
the WORK provided for in such contract, and any authorized extension or modification thereof, including
all amounts due for materials, lubricants, oil, gasoline, coal and coke, repairs on machinery, equipment
and tools, consumed or used in connection with the construction of such work, and all insurance
premiums on said WORK, and for all labor, performed of such WORK, and all insurance premiums on
said WORK, and for all labor, performed in such WORK whether by SUBCONTRACTOR or otherwise,
then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED FURTHER, that the said Surety, for value received hereby stipulates and agrees that no
change, extension of time, alteration, or addition to the terms of the contract or to WORK to be performed
thereunder or the SPECIFICATIONS accompanying the same shall in any way affect its obligation on this
BOND, and it does hereby waive notice of any such change, extension of time, alteration or addition to
the terms of the contract or to the WORK or the SPECIFICATIONS.

PROVIDED, FURTHER, that no final settlement between the OWNER and the CONTRACTOR shall
abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.
<table>
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<tr>
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<td>Telephone_</td>
<td>Fax_</td>
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<tr>
<td>Email Address_</td>
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</table>

Name and address of Resident Agent of Surety: ________________________________

____________________________________

IMPORTANT: Surety companies executing BONDS must appear on the Treasury Department’s most current list (Circular 570 as amended) and be authorized to transact business in the state where the PROJECT is located.

END OF DOCUMENT
DOCUMENT 00 70 00

GENERAL CONDITIONS

1.1 DOCUMENTS
A. American Institute of Architects Document A107-2017, Standard Form of Agreement Between Owner and Contractor for a Project of Limited Scope has its own stand-alone General Conditions of the Contract for Construction, AIA Document A201-2017, forms a part of this Contract and by reference is incorporated herein as fully as if repeated at length.


1.2 RELATED REQUIREMENTS
A. Division 1 - General Requirements.
B. Document 00 80 00 - Supplementary Conditions.
C. Chapter 2258 of the Texas Government Code: Prevailing Wage Rates.

END OF DOCUMENT
1.1 RELATED REQUIREMENTS
A. Document 00 70 00 - General Conditions.

1.2 GENERAL
A. The following supplements modify, delete from, or add to the Standard Form of Agreement Between Owner and Contractor referenced above.
B. Where any provision of the Agreement is modified, unaltered provisions remain in effect.

1.3 SUPPLEMENTS
A. Article 4 – Payments:
   1. Add to 4.1.4, Retainage, if any, shall be withheld as follows: "Until Substantial Completion the Owner will retain 5 percent of the amount due the Contractor on account of progress payments. Upon Final Completion retainage will be reduced to 0 percent."
B. Article 5 – Binding Dispute Resolution
   1. Following Litigation in a court of competent jurisdiction, add "within Cameron County, TX"
C. Article 7 - General Provisions:
   1. Add Subparagraph 7.4.1: "The term 'product' includes materials, systems, and equipment."
   2. Add Subparagraph 7.4.2: "The term 'furnish' means to supply and deliver to Project site, ready for unloading, unpacking, assembly, erection, placement or similar requirements."
   3. Add Subparagraph 7.4.3: "The term 'install' means to unload, unpack, assemble, erect, place, finish, protect, adjust, and clean, or similar requirements."
   4. Add Subparagraph 7.4.4: "The term 'provide' means to furnish and install."
D. Article 9 - Contractor:
   1. Add Subparagraph 9.3.4: "The Contractor shall comply with the prevailing wage law in accordance with The Davis-Bacon Act including any amendments or supplements thereto, and shall pay not less than the minimum wage rates established in the Contract Documents. Contractor may pay higher rates than the minimum prevailing wage rates given, however, the Owner will not be liable for claims for additional compensation because of payment by Contractor of any wage rates in excess of the minimum prevailing wage rates."
   2. Delete paragraph 9.5; substitute the following: "The Owner qualifies for exemption from the State of Texas and local sales and use taxes pursuant to the provisions of the Texas Limited Sales, Excise and Use Tax Act. The Contractor shall not pay any such taxes that would otherwise be payable in connection with the performance of this Contract, but shall instead obtain an exemption by complying with the State Comptroller's requirements. Exemption certificates will be furnished to the Contractor by the Owner."
E. Article 10 - Architect:
   1. Add Subparagraph 10.10:
10.10 Architect’s Additional Services:

10.10.1 The Architect and his consultants will receive additional compensation for work performed under the following circumstances:

.1 Review of Contractor's or subcontractors submittals out of sequence from the submittal schedule agreed to by the Architect.

.2 Responses to the Contractor’s or subcontractors requests for information where such information is available to the Contractor or subcontractors from a careful study and comparison of the Contract Documents, field conditions, Owner-provided information, Contractor – or subcontractor -prepared coordination drawings, or prior Project correspondence or documentation.

.3 Change Order and Construction Change Directives requiring evaluation of proposals, including revisions to the Contract Documents.

.4 Providing consultation concerning replaces or repair of Work, resulting from fire, water damage, or other cause during construction, if the or other cause is the result of actions by the General Contractor or its subcontractors in connection with the Work.

.5 Subcontractors are to bid the project according to requirements in the Construction Documents. If a cost savings is realized by the Owner from a subcontractor-suggested substitution, then the Owner will pay for the architect and consultants' fees and expenses related to review of the substitution. If the substitution is not accepted, or there is no cost savings proposed, then the subcontractor must pay for the architect and his consultants' fees and expenses related to review of the substitution.

.6 Submittal review in excess of the original submittal and one re-submittal.

.7 Review of mock-ups in excess of the original submittal and on re-submittal, unless additional mock-ups are required by the Architect, Owner, or the Texas Historical Commission. Should additional mock-ups be required, Contractor will be compensated for such work.

.8 Review and documentation of defective or nonconforming work due to the Contractor's or any subcontractor's failure to comply with Contract Document requirements.

.9 Services provided after the original Substantial Completion date if delay of Substantial Completion was caused by actions of the Contractor or any Subcontractor.

.10 Substantial or Final Completion inspections in excess of two inspections.

.11 Additional bidding services required to:
   a. Re-bid Work that has already been bid.
   b. Qualify additional subcontractors after the initial bidding period.
   c. Re-bid any bid packages due to the subcontractor bids exceeding the Contractor's estimate that was established prior to bidding.

.12 Required revisions to the Construction Documents after the initial bidding period due to the bids exceeding the Owner's budget unless outside the Contractor's control due to market condition changes that can be substantiated between the date of the contractor's final cost estimate and the bid due date.

.13 Change Order and Construction Change Directive requiring evaluation of proposals, including revisions of the Contract Documents where changes are due to defective or non-conforming Work by the General Contractor or its subcontractors in connection with the Work.

.14 Changes to the Construction Documents made necessary by acceptance of a substitution.
   a. Substitutions will only be reviewed and considered for acceptance if they provide cost reductions to be realized by the Owner. These reductions must include any fees and expenses related to additional services required by the Architect or their consultants to modify the Construction Documents.

.15 Evaluation of an extensive number of claims by the Contractor or any subcontractor in connection with the Work.
10.10.2 The Owner will compensate the Architect and his consultants for additional time and expenses related to any of the above services, and will deduct the amount of such services from the Contractor's Contract Sum by Change Order. Additional services will be preformed after notification to the Contractor that services of the Architect are required due to circumstances identified above. The Architect's Additional Services will be calculated at the following rates:

.1 Senior Principal $ 250.00
.2 Principal $ 200.00
.3 Architect/Designer/Project Manager $ 140.00
.4 Architectural Intern/Designer/Project Manager $ 100.00
.5 Senior Historic Preservation Specialist $ 140.00
.6 Historic Preservation Specialist $ 100.00
.7 Administrative $  75.00

F. Article 13 – Changes in the Work
   a. Add Subparagraph 13.2.1 “The increase in the original Contract amount as a result of change orders shall not be a total cumulative in excess of 25% as allowed by Texas Local Government Code 262.031 (b).”

G. Article 16 - Protection of Persons and Property:
   1. Add Paragraph 16.3: "The Contractor shall not knowingly use any materials containing asbestos or other known hazardous materials in the Work."

H. Article 17 - Insurance and Bonds:
   1. In Subparagraph 17.1, following the word "located", add "and against whom the Owner has no reasonable objection."
   2. Add the following to the end of Subparagraph 17.1: "The form of the Certificate of Insurance shall be ACORD form 25S or other form acceptable to the Owner and shall add the Owner as additional insured."
   3. Add Subparagraph 17.1.1: "Liability insurance shall include all major divisions of coverage and be on a comprehensive basis including:
      .1 Premises-Operations including X, C and U coverages as applicable.
      .2 Independent Contractors' Protective.
      .3 Products and Completed Operations.
      .4 Personal Injury Liability with Employment Exclusion deleted.
      .5 Contractual.
      .6 Owned, non-owned and hired motor vehicles.
      .7 Broad Form Property Damage including Completed Operations."
   4. Add Subparagraph 17.1.2: "The insurance required by Subparagraph 17.1 shall be written for not less than the following limits or those required by law, whichever is greater and shall include the following coverages as a minimum:
      .1 Worker's Compensation:
         (a) State: Statutory.
         (b) Applicable Federal: Statutory.
         (c) Employer's Liability: $500,000 per accident; $500,000 per disease, Policy Limit; $500,000 per disease, each employee.
      .2 General Liability including Premises-Operations; Independent Contractors' Protective; Products and Completed Operations; Broad Form Property Damage:
         (a) Bodily Injury and Property Damage: $1,000,000 combined single limit.
         (b) Products and Completed Operations shall be maintained for 2 years after final payment. Provide evidence of coverage on annual basis.
         (c) Property Damage Liability: Include X, C and U coverage.
         (d) Contractual Liability: $1,000,000 combined single limit.
         (e) Personal Injury, with Employment Exclusion deleted: $1,000,000 aggregate.
(f) If the General Liability policy includes a General Aggregate, such General Aggregate shall be not less than $2,000,000. Policy shall be endorsed to have General Aggregate apply to this Project only.

.3 Automobile Liability including owned, non-owned and hired vehicles:
   (a) Bodily Injury and Property Damage: $1,000,000 combined single limit.

.4 Umbrella Excess Liability: $4,000,000 over primary insurance.

5. Modify the first sentence of Subparagraph 17.3.1 as follows: Delete "Unless otherwise provided, the Owner"; substitute "The Contractor." Delete "the initial Contract Sum, plus the value of subsequent modifications and cost of materials supplied and installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles;"

6. Delete Subparagraph 17.3.2; substitute the following: "Before an exposure to loss may occur, the Contractor shall file with the Owner two certified copies of the policy or policies providing this coverage, containing those endorsements specifically related to this Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner. If the Owner is damaged by the failure of the Contractor to maintain such insurance, then the Contractor shall bear all reasonable costs properly attributable thereto."

7. Modify Subparagraph 17.3.3 by substituting "Contractor" for "Owner" at the end of the first sentence.

8. Modify Subparagraph 17.3.4 by substituting "Contractor" for "Owner" as fiduciary; except that at the first reference to "Owner" in the first sentence, "this" shall be substituted for "Owner's."

9. Delete Subparagraph 17.4.1; substitute the following: "Furnish to Owner performance bond and labor and material payment bond, each equal to the amount of the Contract Sum, with approved surety, covering faithful performance of Contract and payment of obligations incurred in performance of Contract and also for use and benefit of parties who may become entitled to liens under the Contract according to provisions of laws of the State in which the project is located. The form of the bonds shall be acceptable to Owner."

10. Add Clause 17.4.1.1: "The Contractor shall deliver the required bonds to the Owner not later than three days following the date of execution of the Owner - Contractor Agreement, or if the Work is to be commenced prior thereto in response to a letter of intent, the Contractor shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished."

11. Add Clause 17.4.1.2: "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."

END OF DOCUMENT
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Project description.
   2. Work by Others.
   3. Contractor use of site and premises.

1.2 PROJECT DESCRIPTION

A. Work of this Project is described as the Milam County Annex Rehabilitation, in Cameron, Texas.

B. The Work of this project includes the rehabilitation of a former hospital building into governmental offices for Milam County. The work will include selective demolition, site work, new and repaired mechanical, electrical and plumbing systems, remodeled/rehabilitated/altere interior spaces, new entries, commercial kitchen upgrades and other work as required.

C. The Project will be constructed under a single prime contractor with the Owner.

1.3 WORK BY OTHERS

A. Separate Contracts:
   1. The Owner may execute contracts for additional work at the site that is excluded from the work of this Contract.
   2. Work under separate contract may be executed concurrent with Work of this Contract.
   3. Cooperate with the Owner and separate contractors to accommodate this requirement.

1.4 CONTRACTOR’S USE OF SITE AND PREMISES

A. Limit use of site and premises to allow for:
   1. Work by separate contractors.
   2. Work by Owner.

B. The building will be vacant during the period of construction.

C. Contractor shall at all times conduct operations in a manner that ensures the safety of the building and its occupants.

D. Coordinate use of site and premises with the Owner.

E. Move any stored products under Contractor’s control that interfere with the operations of the Owner or separate contractors.

F. Assume full responsibility for protection and safekeeping of products under this Contract stored on site.

G. Obtain and pay for use of any additional storage or work areas needed for operations.
PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION
PART 1 – GENERAL

1.1 SUMMARY
A. Section Includes: Documentation of changes to Contract Sum and Contract Time.
B. Contract Documents contain pertinent requirements for materials and methods to accomplish work described herein.
C. Provide alternate costs for inclusion in Contract Sum if accepted by Owner.

1.2 RELATED REQUIREMENTS
A. Owner-Contractor Agreement: Alternates accepted by Owner for incorporation into the Work.
B. Individual specification sections identified.

1.3 PROCEDURES
A. Alternates will be exercised at the option of Owner.
B. Coordinate related work and modify surrounding work as required to complete the work, including changes under each Alternate, when acceptance is designated in Owner-Contractor Agreement.

1.4 DESCRIPTION ALTERNATES
A. Alternate No. 1: Re-pave East Parking Lot
   1. Base Bid: No work to east parking lot and connecting drives.
   2. Alternate Bid: Re-pave existing east parking lot and connecting drives to North Crockett Avenue with asphalt and re-strip parking spaces. Prep surfaces as required to maintain current elevations and accommodate proper installation of asphalt paving.
      a. Related Specification Sections:
         (1) Section 32 11 00 – Plant Mix Bituminous Pavements
         (2) Section 32 17 23 – Pavement Markings
B. Alternate No. 2: Repave West Parking Lot
   1. Base Bid: No work to west parking lot with the exception of the following: striping for standard and handicap parking spaces and accessible aisle, ADA parking signage, and concrete wheel stops at each parking space.
   2. Alternate Bid: Complete work in base bid. Additionally, re-pave existing west parking lot and connecting drives with asphalt and re-strip parking spaces. Prep surfaces as required to maintain current elevations and accommodate proper installation of asphalt paving.
      a. Related Specification Sections:
         (1) Section 32 11 00 – Plant Mix Bituminous Pavements
         (2) Section 32 17 23 – Pavement Markings
C. Alternate No. 3: Provide ADA Parking Adjacent to North Entry
   1. Base Bid: No work to existing drives.
2. **Alternate Bid:** Provide ADA parking space adjacent to north entry. Work includes striping parking space and aisle, ADA parking sign, concrete wheel stop, concrete curb ramp, and concrete side walk extending to accessible route. Re-paving of drive is contingent upon acceptance of Alternate No. 2.
   a. **Related Specification Sections:**
      (1) Section 10 14 23 - Signage
      (2) Section 32 11 00 – Plant Mix Bituminous Pavements
      (3) Section 32 17 23 – Pavement Markings

D. **Alternate No. 4:** Replace Existing Roof Mounted Outdoor Air Handling Unit
   1. **Base Bid:** Retain existing roof mounted outdoor air handling unit and make fully functional
   2. **Alternate Bid:** Remove existing roof mounted outdoor air handling unit and replace with Daikin DPSA050 100% Outside Air Unit, or approved equal. Refer to drawings for additional information.
      a. **Related Specification Sections:**
         (1) Section 23 72 12 – Semi-Custom Packaged Rooftop Air Conditioners

E. **Alternate No. 5:** Provide 2nd Chiller
   1. **Base Bid:** Utilize existing Chiller system without adding additional capacity. Provide blind flange connections for future chiller.
   2. **Alternate Bid:** Provide new Air-Cooled Chiller equal to Daikin AGZ101E, or approved equal. Refer to drawings for additional information.
      a. **Related Specification Sections:**
         (1) Section 23 64 28 – Air-Cooled Chillers

F. **Alternate No. 6:** Provide Lightning Protection System
   1. **Base Bid:** No lightning protection system.
   2. **Alternate Bid:** Contractor shall design and provide lightning protection system complying with requirements of UL 96A for a Master “C” Label and referenced Specification Section. UL master label shall be obtained.
      a. **Related Specification Sections:**
         (1) Section 26 41 00 – Lightning Protection System

G. **Alternate No. 7:** Replace Suspended Gyp. Board Ceiling in Kitchen Areas
   1. **Base Bid:** Retain existing suspended gyp. Board ceilings in the following spaces: Dishwashing 102C, Freezer Room 102D, Kitchen 102E, and Storage 102K. Selectively remove and replace portions of ceiling as require to provide specified MEP systems. Restore ceiling to provide a seamless transition between new and existing areas. Finish as specified.
   2. **Alternate Bid:** Remove and replace existing suspended gyp. Board ceilings in the following spaces: Dishwashing 102C, Freezer Room 102D, Kitchen 102E, and Storage 102K. Coordinate installation with installation of specified MEP systems. Finish as specified.
      a. **Related Specification Sections:**
         (1) Section 09 29 00 – Gypsum Board Assemblies
         (2) Section 09 91 00 – Painting and Finishing

H. **Alternate No. 8:** Selective Exterior Work at the Convent
   1. **Base Bid:** No work to the Convent
   2. **Alternate Bid:** Complete exterior work indicated on Sheet A3.02.
I. Alternate No. 9: Asbestos Abatement at the Convent
   1. Base Bid: No work to the Convent
   2. Alternate Bid: Remove asbestos containing materials at the Convent per Asbestos Abatement Specifications in the Appendix of the Project Manual.

PART 2 – PRODUCTS

2.1 Not used.

PARTS 3 – EXECUTION

3.1 Not used.

END OF SECTION
PART 1- GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Architect's Supplemental Instructions.
   2. Proposal Requests.
   3. Contractor's proposed changes.
   5. Change Orders.

B. Related Sections:
   1. Section 01 60 00 - Product Requirements.

1.2 CHANGE PROCEDURES

A. Architect's Supplemental Instructions:
   1. Architect will advise of minor changes in Work not involving an adjustment to Contract Sum or Contract Time as authorized by the Conditions of the Contract.

B. Proposal Requests:
   1. Architect may issue a Proposal Request that includes a detailed description of a proposed change with supplemental or revised Drawings and specifications.
   3. Prepare and submit an estimate of any change to Contract Sum or Contract Time within 7 days.

C. Contractor's Proposed Changes:
   1. Contractor may propose a change by submitting request for change to Architect.
   2. Describe proposed change, reason for change, its full effect on Work, and any change to Contract Sum or Contract Time.
   3. Document any required substitutions in accordance with Section 01 60 00.

D. Construction Change Directive:
   1. Architect may issue a directive, signed by Owner, instructing Contractor to proceed with a change for subsequent inclusion in a Change Order. Document will describe changes in Work and designate method of determining any change to Contract Sum or Contract Time. Promptly execute change.

E. Change Orders:
   2. Execution: Architect will issue Change Orders for signature of parties as provided in Conditions of the Contract.
1.3 DISTRIBUTION

A. Distribute copies of change procedure documents to Owner, Architect and subcontractors and suppliers as applicable.

PART 2 - PRODUCTS

2.1 Not used.

PART 3 - EXECUTION

3.1 Not used.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Schedule of Values.
   2. Applications for Payment.

1.2 SCHEDULE OF VALUES

A. General:
   1. Submit a Schedule of Values to Owner and Architect at least 20 days prior to submitting first Application for Payment.
   2. Upon request of Owner or Architect, furnish additional data to support values given that will substantiate their correctness.
   3. Approved Schedule of Values will be used as basis for reviewing Contractor’s Applications for Payment.

B. Form and Content:
   1. Format: AIA Document G703 - Continuation Sheet of Application and Certification for Payment. Contractor’s standard electronic media printout will be considered.
   2. Use Table of Contents of Project Manual as basis of format for listing costs of Work.
   3. List installed value of component parts of Work in sufficient detail to serve as basis for computing values for progress payments.
   4. Include separate line items for:
      a. Site mobilization.
      b. Bonds and insurance.
      c. Contractor’s overhead and profit.
   5. No payment request shall be made for stored materials off site.
   6. For each line item that has a value of more than $25,000.00, break down costs to list major products or operations under each item.
   7. Total of costs listed in Schedule shall equal Contract Sum.

C. Review and Resubmittal:
   1. After initial review by Owner and Architect, revise and resubmit if required.
   2. Revise and resubmit along with next Application for Payment when a Change Order is issued. List each Change Order as a new line item.

1.3 APPLICATIONS FOR PAYMENT

A. Preparation:
   1. Format: AIA Document G702 - Application and Certification for Payment, supported by AIA Document G703 - Continuation Sheet. Contractor’s standard electronic media printout will be considered.
   2. Prepare required information in typewritten format or on electronic media printout.
3. Use data from reviewed Schedule of Values. Provide dollar value in each column for each line item representing portion of work performed.
4. List each authorized Change Order as a separate line item, listing Change Order number and dollar value.
5. Prepare Application for Final Payment as specified in Section 01 77 00.

B. Waivers of Lien:
   1. Along with the each Application for Payment, submit waivers of lien from each Subcontractor or Sub-subcontractor included on the current month's Application for Payment.
   2. Submit partial waivers on each item for amount requested, prior to deduction of retainage.
   3. For completed items, submit full or final waiver.

C. Substantiating Data:
   1. When Owner or Architect requires substantiating information, submit data justifying dollar amounts in question.
   2. Provide one copy of data with cover letter showing Application number and date, and line item number and description.

D. Submittal:
   1. Submit three copies of each Application for Payment.
   2. Payment period: Submit at intervals stipulated in Agreement.

PART 2 - PRODUCTS

2.1 Not used.

PART 3 - EXECUTION

3.1 Not used.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Project coordination.
   2. Project meetings.

1.2 PROJECT COORDINATION

A. Coordinate scheduling, submittals, and work of various Sections of specifications to assure efficient and orderly sequence of installation of interdependent construction elements.

B. Verify that utility requirement characteristics of operating equipment are compatible with building utilities. Coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service such equipment.

C. In finished areas, conceal pipes, and wiring within construction. Coordinate locations of devices and outlets with finish elements.

D. Coordinate completion and clean up of work of separate Sections in preparation for Substantial Completion.

E. Coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents to minimize disruption of Owner's activities.

1.3 PROJECT MEETINGS

A. Schedule and administer preconstruction conference and progress meetings.

B. Make physical arrangements for meetings; notify involved parties at least four days in advance.

C. Record significant proceedings and decisions at each meeting; reproduce and distribute copies to:
   1. Parties in attendance.
   2. Others affected by proceedings and decisions made.

D. The Architect will attend a single meeting each month at the project site during construction. The Contractor is required to manage, coordinate, and schedule the required mock-ups for review and approval according to the Architect’s schedule for monthly site visits.

1.4 PRECONSTRUCTION CONFERENCE

A. Schedule within 15 days after date of Notice to Proceed at project field office or other central site, convenient to all parties.

B. Attendance:
   1. Architect.
   2. Contractor.
   3. Major subcontractors and suppliers as Contractor deems appropriate.
C. Review and Discuss:
   1. Relation and coordination of various parties, and responsible personnel for each party.
   2. Use of premises, including office and storage areas, temporary controls, and security procedures.
   3. Construction schedule and critical work sequencing.
   4. Processing of:
      a. Contract modifications.
      b. Shop Drawings, Product Data, and Samples.
      c. Applications for Payment.
      d. Substitutions.
      e. Other required submittals.

1.5 PROGRESS MEETINGS

A. Schedule periodic progress meetings as required by the progress of the Work.

B. Location: Project site, exact location: 806 N Crockett Avenue.

C. Attendance:
   1. Architect and consultants as appropriate to agenda.
   2. Contractor.
   3. Owner's Designated Project Manager.
   4. Subcontractors and suppliers as appropriate to agenda.
   5. Others as appropriate to agenda.

D. Review and Discuss:
   1. Work progress since previous meeting, including:
      a. Field observations, deficiencies, conflicts, and problems.
      b. Progress and completion date.
      c. Corrective measures needed to maintain quality standards, progress, and completion date.
   2. Status of:
      a. Requests for Information (RFIs).
      b. Contract Modifications.
   3. Coordination between various elements of Work.
   4. Maintenance of Project Record Documents.

PART 2- PRODUCTS

2.1 Not used.

PART 3 EXECUTION

3.1 Not used.

END OF SECTION
SECTION 01 32 00
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Progress schedule.
   2. Construction photographs.

B. Related Sections:
   1. Section 01 29 00 - Payment Procedures.
   2. Section 01 33 00 - Submittal Procedures: Shop Drawings, Product Data, and Samples.
   3. Section 01 77 00 - Closeout Procedures.

1.2 PROGRESS SCHEDULE

A. Format:
   1. Prepare Schedules as a horizontal bar chart with separate bar for each major portion of Work or operation, identifying first work day of each week.
   2. Sequence of listings: The chronological order of the start of each item of Work.
   3. Scale and spacing: To provide space for notations and revisions.
   4. Sheet size: Multiples of 8-1/2 x 11 inches.

B. Content:
   1. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
   2. Identify each item by specification Section number.
   3. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.
   4. Provide separate schedule of submittal dates for Shop Drawings, Product Data, and Samples, including:
      a. Dates reviewed submittals will be required from Architect.
      b. Decision data for selection of finishes.
      c. Delivery dates for Owner furnished products.
      d. Progress payment dates.
   5. Coordinate content with Schedule of Values specified in Section 01 29 00.
   6. Revisions:
      a. Indicate progress of each activity to date of submittal, and projected completion date of each activity.
      b. Identify activities modified since previous submittal, major changes in scope, and other identifiable changes.
   7. Provide narrative report to define problem areas, anticipated delays, and impact on Schedule. Report corrective action taken, or proposed, and its effect.
C. Submittal:
   1. Submit initial Schedules to Owner and Architect within 15 days after date of Notice to Proceed.
      After review, resubmit required revised data within 10 days.
   2. Submit revised Progress Schedules with each Application for Payment.
   3. Submit the number of opaque reproductions that Contractor requires, plus one copy each for
      Owner and Architect.

D. Distribution:
   1. Distribute copies of approved Schedules to project site file, Subcontractors, suppliers, and
      other concerned parties.
   2. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in
      Schedules.

1.3 CONSTRUCTION PHOTOGRAPHS

A. Photography:
   1. Employ photographer to take construction progress photographs during construction.
   2. Provide photographs taken each month just prior to date for each scheduled Application for
      Payment.
   3. Illustrate:
      a. Conditions prior to commencement of work.
      b. Major construction events.
      c. Conditions upon Substantial Completion.
   4. Photograph project from minimum of Ten (10) different views at each specified time; views as
      directed by Architect.
   5. After selective demolition work has commenced, take five (5) additional photographs of roof
      and foundation; views as directed by Architect.
   6. At successive periods of photography, take photographs from same overall view as previously
      taken.
   7. Provide factual presentation.
   8. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field,
      and minimum distortion.

B. Progress Photographs:
   1. Provide index to progress photos and reduced plan(s) keyed and numbered to each photo,
      label and date.
   2. Photographic format: Digital at 1600 x 1200 resolution or 35 mm, color.
   3. Labels: Subject and date.
   4. Negatives: Provide copies of index and progress photos on compact disk in jpeg format.

C. Record Photographs:
   1. Provide index to record photos and reduced plan(s) keyed and numbered to each photo, label
      and date.
   2. Photographic format: Professional quality, perspective corrected lens preferred.
   3. Three (3) copies of digital image data on a compact disk or thumb drive.
   4. Content: Roof and foundation.
   5. Intervals: All views captured at three times: before work begins, during investigative or
      construction work and upon completion.
   6. Labels: Subject, view, date and photographer.
7. Negatives: Photographic negatives in archival sleeves or a digital copy on compact disk in jpeg format.

D. Submittal:
   1. Progress photos:
      a. Three copies of digital image data on a compact disk.

PART 2 - PRODUCTS

2.1 Not used.

PART 3 - EXECUTION

3.1 Not used.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Submittal procedures.
   2. Submittal schedule.
   3. Proposed Products list.
   4. Shop Drawings.
   5. Product Data.
   6. Samples.
   7. Quality control submittals.

B. Related Sections:
   1. Section 01 40 00 - Quality Requirements.

1.2 SUBMITTAL PROCEDURES

A. Transmit each submittal along with an electronic form approved by Architect.

B. Number each submittal with Project Manual section number and a sequential number within each section. Number resubmittals with original number and an alphabetic suffix.

C. Identify Project Contractor, Subcontractor or supplier, pertinent Drawing sheet and detail numbers, and specification Section number, as appropriate.

D. Apply Contractor's stamp, signed or initialed certifying that:
   1. Submittal was reviewed.
   2. Products, field dimensions, and adjacent construction have been verified.
   3. Information has been coordinated with requirements of Work and Contract Documents.

E. Schedule submittals to expedite the Project, and deliver to Architect and Owner. Coordinate submittal of related items. All submittals are required to be received within the first 30 days of construction.

F. For each submittal, allow 14 days for Architect's review, excluding delivery time to and from Contractor.

G. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of completed Work.

H. Provide space for Contractor and Architect review stamps.

I. Revise and resubmit submittals when required; identify all changes made since previous submittal.

J. Distribute electronic copies of reviewed submittals to concerned parties and to Project Record Documents file. Instruct parties to promptly report any inability to comply with provisions.
1.3 SUBMITTAL SCHEDULE
A. Within 15 days after the date of the Notice to Proceed, submit a complete list of submittals required for Project to Architect and Owner.

B. For each submittal, indicate on schedule:
   1. Applicable specification section number.
   2. Type of submittal, e.g. Shop Drawing, Product Data, Sample, Certificate, etc.
   3. Indication of whether submittal is for review or for information purposes only.
   4. Anticipated date of submittal to Architect.
   5. Date reviewed copies must be returned to Contractor.

C. Architect will review Submittal Schedule for conformance to requirements of Contract Documents and will return one copy to Contractor with comments as applicable.

1.4 PROPOSED PRODUCTS LIST
A. Within 15 days after date of Notice to Proceed, submit to Architect and Owner a complete list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.5 SHOP DRAWINGS
A. Shop Drawings are drawings, diagrams, schedules, and other data specifically prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

B. Present information in clear and thorough manner.

C. Identify details by reference to sheet and detail numbers or room number shown on Drawings.

D. Maximum Sheet Size for printing: 30 x 42 inches.

E. Submit one electronic pdf copy of drawings to Architect and Owner.

F. Architect will return electronic copy to Contractor for printing and distribution.

1.6 PRODUCT DATA
A. 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.

B. Mark each electronic copy to identify applicable products, models, options, and other data.

C. Supplement manufacturers' standard data to provide information unique to this Project.

D. Submit one electronic copy in pdf format.

E. Architect will return one copy to Contractor for printing and distribution.
1.7 SAMPLES

A. Samples are physical examples, which illustrate materials, equipment, or workmanship and establish standards for which the Work will be judged.

B. Submit samples to illustrate functional and aesthetic characteristics of Products, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

C. Where so indicated, submit samples of finishes from the full range of manufacturers’ standard colors, textures, and patterns for Architect's selection.

D. Include identification on each sample, with full Project information.

E. Unless otherwise specified in individual specifications, submit two of each sample.

F. Architect will notify Contractor of approval or rejection of samples, or of selection of color, texture, or pattern if full range is submitted.

1.8 QUALITY CONTROL SUBMITTALS

A. Quality control submittals specified in Section 01 40 00 are for information and do not require Architect’s responsive action except to require resubmission of incomplete or incorrect information.

PART 2 - PRODUCTS

2.1 Not used.

PART 3 - EXECUTION

3.1 Not used.

END OF SECTION
SECTION 01 35 16
ALTERATION PROJECT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY
A. Section includes special procedures for alteration work.

1.2 DEFINITIONS
A. Alteration Work: This term includes rehabilitation, remodeling, renovation, repair, and maintenance work performed within existing spaces or on existing surfaces as part of the Project.
B. Consolidate: To strengthen loose or deteriorated materials in place.
C. Design Reference Sample: A sample that represents the Architect's pre-bid selection of work to be matched; it may be existing work or work specially produced for the Project.
D. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.
E. Match: To blend with adjacent construction and manifest no apparent difference in material type, species, cut, form, detail, color, grain, texture, or finish; as approved by Architect.
F. Refinish: To remove existing finishes to base material and apply new finish to match original, or as otherwise indicated.
G. Repair: To correct damage and defects, retaining existing materials, features, and finishes. This includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials.
H. Replace: To remove, duplicate, and reinstall entire item with new material. The original item is the pattern for creating duplicates unless otherwise indicated.
I. Replicate: To reproduce in exact detail, materials, and finish unless otherwise indicated.
J. Reproduce: To fabricate a new item, accurate in detail to the original, and from either the same or a similar material as the original, unless otherwise indicated.
K. Retain: To keep existing items that are not to be removed or dismantled.
L. Strip: To remove existing finish down to base material unless otherwise indicated.

1.3 PROJECT MEETINGS FOR ALTERATION WORK
A. Preliminary Conference for Alteration Work: Before starting alteration work, conduct conference at Project site, 806 N. Crockett Avenue in Cameron, Texas.
1. Attendees: Representatives of Owner, Architect, Contractor and testing service representative shall be present at the meeting.
2. Agenda: Discuss items of significance that could affect progress of alteration work, including review of the following:
   a. Fire-prevention plan.
   b. Governing regulations.
   c. Areas where existing construction is to remain and the required protection.
   d. Hauling routes.
   e. Sequence of alteration work operations.
   f. Storage, protection, and accounting for salvaged and specially fabricated items.
   g. Existing conditions, staging, and structural loading limitations of areas where materials are stored.

3. Reporting: Record conference results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from conference.

B. Coordination Meetings: Conduct coordination meetings specifically for alteration work at regular intervals. Coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

   1. Agenda: Review and correct or approve minutes of previous coordination meeting. Review other items of significance that could affect progress of alteration work. Include topics for discussion as appropriate to status of Project.
   2. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.4 MATERIALS OWNERSHIP

A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered or uncovered during the Work, regardless of whether they were previously documented, remain Owner's property.

1.5 INFORMATIONAL SUBMITTALS

A. Alteration Work Program: Submit 30 days before work begins.

B. Fire-Prevention Plan: Submit 30 days before work begins.

1.6 QUALITY ASSURANCE

A. Title X Requirement: Each firm conducting activities that disturb painted surfaces shall be a "Lead-Safe Certified Firm" according to 40 CFR 745, Subpart E, and use only workers that are trained in lead-safe work practices.

B. Alteration Work Program: Prepare a written plan for alteration work for whole Project, including each phase or process and protection of surrounding materials during operations. Show compliance with indicated methods and procedures specified in this and other Sections. Coordinate this whole-Project alteration work program with specific requirements of programs required in other alteration work Sections.

   1. Dust and Noise Control: Include locations of proposed temporary dust- and noise-control partitions and means of egress from occupied areas coordinated with continuing on-site operations and other known work in progress.
   2. Debris Hauling: Include plans clearly marked to show debris hauling routes, turning radii, and locations and details of temporary protective barriers.
C. Fire-Prevention Plan: Prepare a written plan for preventing fires during the Work, including placement of fire extinguishers, fire blankets, rag buckets, and other fire-control devices during each phase or process. Coordinate plan with Owner's fire-protection equipment and requirements. Include fire-watch personnel's training, duties, and authority to enforce fire safety.

D. Safety and Health Standard: Comply with ANSI/ASSE A10.6.

1.7 STORAGE AND HANDLING OF SALVAGED MATERIALS

A. Salvaged Materials:
   1. Clean loose dirt and debris from salvaged items unless more extensive cleaning is indicated.
   2. Pack or crate items after cleaning; cushion against damage during handling. Label contents of containers.
   3. Store items in a secure area until delivery to Owner.
   4. Transport items to Owner's storage area designated by Owner.
   5. Protect items from damage during transport and storage.

B. Salvaged Materials for Reinstallation:
   1. Repair and clean items for reuse as indicated.
   2. Pack or crate items after cleaning and repairing; cushion against damage during handling. Label contents of containers.
   3. Protect items from damage during transport and storage.
   4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment unless otherwise indicated. Provide connections, supports, and miscellaneous materials to make items functional for use indicated.

C. Existing Materials to Remain: Protect construction indicated to remain against damage and soiling from construction work. Where permitted by Architect, items may be dismantled and taken to a suitable, protected storage location during construction work and reinstalled in their original locations after alteration and other construction work in the vicinity is complete.

D. Storage: Catalog and store items within a weathertight enclosure where they are protected from moisture, weather, condensation, and freezing temperatures.
   1. Identify each item for reinstallation with a nonpermanent mark to document its original location. Indicate original locations on plans, elevations, sections, or photographs by annotating the identifying marks.
   2. Secure stored materials to protect from theft.
   3. Control humidity so that it does not exceed 85 percent. Maintain temperatures 5 deg F or more above the dew point.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 PROTECTION

A. Protect persons, motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm resulting from alteration work.
1. Use only proven protection methods, appropriate to each area and surface being protected.
2. Provide temporary barricades, barriers, and directional signage to exclude the public from areas where alteration work is being performed.
3. Erect temporary barriers to form and maintain fire-egress routes.
4. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during alteration work.
5. Contain dust and debris generated by alteration work, and prevent it from reaching the public or adjacent surfaces.
6. Provide shoring, bracing, and supports as necessary. Do not overload structural elements.
7. Protect floors and other surfaces along hauling routes from damage, wear, and staining.
8. Provide supplemental sound-control treatment to isolate demolition work from other areas of the building.

B. Temporary Protection of Materials to Remain:

1. Protect existing materials with temporary protections and construction. Do not remove existing materials unless otherwise indicated.
2. Do not attach temporary protection to existing surfaces except as indicated as part of the alteration work program.

C. Comply with each product manufacturer’s written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.

D. Utility and Communications Services:

1. Notify Owner, Architect, authorities having jurisdiction, and entities owning or controlling wires, conduits, pipes, and other services affected by alteration work before commencing operations.
2. Disconnect and cap pipes and services as required by authorities having jurisdiction, as required for alteration work.
3. Maintain existing services unless otherwise indicated; keep in service, and protect against damage during operations. Provide temporary services during interruptions to existing utilities.

E. Existing Drains: Prior to the start of work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin work in an area until the drainage system is functioning properly.

1. Prevent solids such as adhesive or mortar residue or other debris from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from alteration work.
2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.

F. Existing Roofing: Prior to the start of work in an area, install roofing protection as required.

3.2 PROTECTION FROM FIRE

A. General: Follow fire-prevention plan and the following:

2. Remove and keep area free of combustibles, including rubbish, paper, waste, and chemicals, unless necessary for the immediate work.
   a. If combustible material cannot be removed, provide fire blankets to cover such materials.
B. Heat-Generating Equipment and Combustible Materials: Comply with the following procedures while performing work with heat-generating equipment or combustible materials, including welding, torch-cutting, soldering, brazing, removing paint with heat, or other operations where open flames or implements using high heat or combustible solvents and chemicals are anticipated:

1. Obtain Owner's approval for operations involving use of open-flame or welding or other high-heat equipment. Notify Owner at least 72 hours before each occurrence, indicating location of such work.
2. As far as practicable, restrict heat-generating equipment to shop areas or outside the building.
3. Do not perform work with heat-generating equipment in or near rooms or in areas where flammable liquids or explosive vapors are present or thought to be present. Use a combustible gas indicator test to ensure that the area is safe.
4. Use fireproof baffles to prevent flames, sparks, hot gases, or other high-temperature material from reaching surrounding combustible material.
5. Prevent the spread of sparks and particles of hot metal through open windows, doors, holes, and cracks in floors, walls, ceilings, roofs, and other openings.
6. Fire Watch: Before working with heat-generating equipment or combustible materials, station personnel to serve as a fire watch at each location where such work is performed. Fire-watch personnel shall have the authority to enforce fire safety. Station fire watch according to NFPA 51B, NFPA 241, and as follows:
   a. Train each fire watch in the proper operation of fire-control equipment and alarms.
   b. Prohibit fire-watch personnel from other work that would be a distraction from fire-watch duties.
   c. Cease work with heat-generating equipment whenever fire-watch personnel are not present.
   d. Have fire-watch personnel perform final fire-safety inspection each day beginning no sooner than 30 minutes after conclusion of work in each area to detect hidden or smoldering fires and to ensure that proper fire prevention is maintained.
   e. Maintain fire-watch personnel at each area of Project site until 60 minutes after conclusion of daily work.

C. Fire-Control Devices: Provide and maintain fire extinguishers, fire blankets, and rag buckets for disposal of rags with combustible liquids. Maintain each as suitable for the type of fire risk in each work area. Ensure that nearby personnel and the fire-watch personnel are trained in fire-extinguisher and blanket use.

3.3 PROTECTION DURING APPLICATION OF CHEMICALS

A. Protect motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm or spillage resulting from applications of chemicals and adhesives.

B. Cover adjacent surfaces with protective materials that are proven to resist chemicals selected for Project unless chemicals being used will not damage adjacent surfaces as indicated in alteration work program. Use covering materials and masking agents that are waterproof and UV resistant and that will not stain or leave residue on surfaces to which they are applied. Apply protective materials according to manufacturer's written instructions. Do not apply liquid masking agents or adhesives to painted or porous surfaces. When no longer needed, promptly remove protective materials.

C. Do not apply chemicals during winds of sufficient force to spread them to unprotected surfaces.

D. Neutralize alkaline and acid wastes and legally dispose of off Owner's property.

E. Collect and dispose of runoff from chemical operations by legal means and in a manner that prevents soil contamination, soil erosion, undermining of paving and foundations, damage to landscaping, or water penetration into building interior.
3.4 GENERAL ALTERATION WORK

A. Record existing work before each procedure (preconstruction), and record progress during the work. Use digital preconstruction documentation photographs. Comply with requirements in Section 01 32 33 "Photographic Documentation."

B. Perform surveys of Project site as the Work progresses to detect hazards resulting from alterations.

C. Notify Architect of visible changes in the integrity of material or components whether from environmental causes including biological attack, UV degradation, freezing, or thawing or from structural defects including cracks, movement, or distortion.

1. Do not proceed with the work in question until directed by Architect.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. References.
   2. Quality assurance and control of installation.
   3. Manufacturer's field services and reports.
   4. Test reports and certifications.
   5. Manufacturer's installation instructions.

1.2 REFERENCES

A. For products or workmanship specified by reference to association, trade, or industry standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

C. Conform to edition of reference standard in effect as of date of Project Manual.

D. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.3 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 fully with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Perform work by persons qualified to produce workmanship of specified quality.

F. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

1.4 MANUFACTURERS' FIELD SERVICES AND REPORTS

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, or startup of equipment, as applicable, and to initiate instructions when necessary.
B. Individuals to report observations and site decisions or instructions given to applicators or installers which are supplemental or contrary to manufacturers' written instructions.

C. Submit report to Architect for review in duplicate within 10 days of observation.

1.5 TEST REPORTS AND CERTIFICATIONS

A. When specified in individual specification Sections, require material or Product suppliers or manufacturers to provide test reports and manufacturers' certifications.

B. Indicate that material or Product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

C. Submittals may be recent or previous test results on material or Product, but must be acceptable to Architect.

D. Submit two copies of each report.

1.6 MANUFACTURER'S INSTALLATION INSTRUCTIONS

A. When Contract Documents require that Products be installed in accordance with manufacturer's instructions:

1. Submit manufacturer's most recent printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, as applicable.
   a. Submit in quantities specified for Product Data.
   b. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
   c. Identify conflicts between manufacturers' instructions and requirements of Contract Documents.

2. Perform installation of Products to comply with requirements of manufacturer's instructions.

3. If installation cannot be performed in accordance with manufacturer's instructions, notify Architect and await instructions.

PART 2 - PRODUCTS

2.1 Not used.

PART 3 - EXECUTION

3.1 Not used.

END OF SECTION
SECTION 01 45 00
TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

A. The testing laboratory shall make all inspections and perform all tests in accordance with the building code, local authorities, ASTM specifications and the Contract Documents.

B. Materials and workmanship not meeting the required standards are to be removed and replaced. Replacement and subsequent testing shall be at the expense of the Contractor.

C. Testing, inspection, and certifications specified in other sections of these Specifications shall be paid by the Contractor, unless otherwise indicated.

D. Inspection by the laboratory shall not relieve the Contractor or Fabricator of his responsibility to furnish materials and workmanship in accordance with the Contract Documents.

1.3 SELECTION AND PAYMENT

A. Owner will employ and pay for services of an independent testing laboratory to perform inspection and testing services specified in this section.

1.4 REFERENCED STANDARDS

A. The latest adopted edition of all standards referenced in this Section shall apply, unless noted otherwise. In case of conflict between these Contract Documents and a referenced standard, the Contract Documents shall govern. In case of conflict between these Contract Documents and the Building Code, the more stringent shall govern.

1.5 QUALITY ASSURANCE

A. Testing Laboratory shall meet the requirements of ASTM E329 and ASTM E543.

B. Testing Laboratory shall be insured against errors and omissions by a professional liability insurance policy having a limit of liability not less than $500,000.

C. Testing Laboratory shall be under the direction of a Registered Engineer licensed in the State of Texas, having at least five years experience in inspection and testing of construction materials.

D. Laboratory staff monitoring concrete work shall be ACI certified inspectors.

E. Laboratory staff performing structural steel inspection shall be currently certified AWS Certified Welding Inspectors (CWI), in accordance with the provisions of AWS QCI, "Standard and Guide for Qualification and Certification of Welding Inspectors". The inspector may be supported by assistant inspectors who may perform specific inspection functions under the supervision of the inspector. Assistant inspectors shall be currently certified AWS Certified Associate Welding Inspectors (CAWI). The work of the assistant inspectors shall be regularly monitored by the inspector, generally on a daily basis.
F. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to either National Bureau of Standards or accepted values of natural physical constants.

1.6 LABORATORY RESPONSIBILITIES

A. Attend preconstruction meetings and progress meetings as required to coordinate work with the Contractor and address quality control issues.

B. Test samples of design mixes submitted by Contractor.

C. Provide qualified personnel at site. Cooperate with Architect/Engineer and Contractor in performance of services.

D. Perform specified inspecting, sampling, and testing of Products in accordance with specified standards.

E. Ascertain compliance of materials and mixes with requirements of Contract Documents.

F. Promptly notify Architect/Engineer and Contractor of observed irregularities or non-conformance of Work or Materials.

G. Perform all inspections and tests in accordance with building code requirements for "Special Inspection" whether or not such inspections are specified in the Contract Documents.

1.7 LABORATORY REPORTS

A. After each inspection and test, promptly submit copies of laboratory reports to Architect, Engineer, Owner and to Contractor.

B. Include:
   1. Date issued
   2. Project title and number
   3. Name of inspector
   4. Date and time of sampling or inspection
   5. Identification of product and specifications section
   6. Location in the Project
   7. Type of inspection or test
   8. Date of test
   9. Results of tests
   10. Conformance with Contract Documents

1.8 LIMITS ON TESTING LABORATORY AUTHORITY

A. Laboratory may not release, revoke, alter, or enlarge the requirements of the Contract Documents.

B. Laboratory may not approve or accept any portion of the Work, except where such approval is specifically called for in these specifications.

C. Laboratory may not assume any duties of Contractor.

D. Laboratory has no authority to stop the Work.

1.9 CONTRACTOR RESPONSIBILITIES

A. See technical sections of these specifications for specific requirements.
B. Deliver to the laboratory, without cost to the Owner, adequate samples of materials proposed for use, which are required to be tested.

C. Advise laboratory sufficiently in advance of construction operations to allow laboratory to complete any required checks or tests and to assign personnel for field inspection and testing as specified.

D. Provide facilities for safe storage and proper curing of concrete test samples on project site for the first 24 hours and also for subsequent field curing as required by ASTM specifications C31.

E. Provide incidental labor and equipment as required to assist laboratory personnel in obtaining and handling samples at the site and in accessing work for inspection.

F. Furnish concrete mix designs, in accordance with ACI 301, section 3.9, made by an independent testing laboratory or qualified concrete supplier. Where mix designs are required, the laboratory shall be selected and paid by the Contractor.

G. Provide current welder certifications for each welder to be employed.

H. Furnish fabrication and erection inspection of all welds in accordance with AWS D1.1, Chapter 6.

I. Prequalification of all welding procedures to be used in executing the work.

PART 2 - PRODUCTS

2.1 Not used.

PART 3 - EXECUTION

3.1 FILLING AND BACKFILLING

A. The Contractor shall make available to the laboratory, adequate samples of each fill and backfill material from the proposed sources of supply not less than 10 days prior to the start of the work.

B. Laboratory shall analyze samples as required to provide a soil description and to determine compliance with quality requirements. Perform the following tests:
   1. Test for liquid limit in accordance with ASTM D423.
   2. Test for plastic limit of soils and plasticity index of soils in accordance with ASTM D424.
   3. Tests for moisture density relations of soil in accordance with ASTM D698 or D1557, as applicable.

C. Furnish a report for each individual test and state whether sample conforms to specified requirements or reasons for nonconformance.

D. Inspect underslab drainage material and placement for compliance with specified gradation, quality and compaction.

E. Make in-place compaction test for moisture content, moisture-density relationship, and density of fill material after compaction to determine that backfill materials have been compacted to the specified density. Number of tests shall be as follows:
   1. One test for each 5000 square feet of area of each lift placed under floor slab. Stagger test locations in each lift from those in the previous lift. Perform a minimum of three tests for each lift.
2. One test for each 100 linear feet, or portion thereof, of each lift placed against foundation walls, with locations staggered from those in the previous lift.

3. One test of each lift placed below any isolated footing, and every 100 linear feet under continuous footings, with locations taken on a different side from that in the lift below.

3.2 CONCRETE REINFORCING STEEL AND EMBEDDED METAL ASSEMBLIES

A. Inspect all concrete reinforcing steel prior to placing of concrete for compliance with the Contract Documents and approved shop drawings. All instances of noncompliance shall be immediately brought to the attention of the Contractor for correction. If uncorrected by the Contractor, they shall be listed in the report.

B. Observe and report on the following:
   1. Number and size of bars.
   2. Bending and lengths of bars.
   4. Clearance to forms including chair heights.
   5. Clearance between bars or spacing.
   6. Rust, form oil, and other contamination.
   7. Grade of Steel.
   8. Securing, tying and chairing of bars.
   10. Installation of anchor bolts and placement of concrete around anchor bolts.
   11. Fabrication and installation of embedded metal assemblies, including visual inspection of all welds.
   12. Visually inspect studs and deformed bar anchors on embedded assemblies for compliance with Contract Documents.

C. Provide a qualified, experienced inspector to inspect reinforcing steel. Inspector shall have a minimum of three years experience inspecting reinforcing steel in projects of similar size.

3.3 CONCRETE INSPECTION AND TESTING

A. Secure composite samples of concrete at the jobsite in accordance with ASTM C172.

B. Mold and cure three specimens from each sample in accordance with ASTM C31. The test cylinders shall be stored in the field 24 hours and then carefully transported to the laboratory and cured in accordance with ASTM C31.

C. Test specimens in accordance with ASTM C39. Two specimens shall be tested at 28 days for acceptance and one shall be tested at seven days for information.

D. Make one strength test (three cylinders) for each 100 cubic yards or fraction thereof, of each mix design placed in one day.

E. Make one slump test for each set of cylinders following the procedural requirements of ASTM C143 and ASTM C172. Make additional slump tests whenever the consistency of the concrete appears to vary. Do not permit placement of concrete having measured slump outside the limits given on the drawings, except when approved by the Architect. Slump tests corresponding to samples from which strength tests are made shall be reported with the strength test results. Other slump tests need not be reported.

F. Determine total air content of air entrained normal-weight concrete sample for each strength test in accordance with ASTM C231.
G. Determine temperature of concrete sample for each strength test.

H. Monitor the addition of water at the jobsite and the length of time the concrete is allowed to remain in the truck before placement. Report any significant deviation from the approved mix design to the Architect, the Contractor, and the concrete supplier.

I. Observe the placing of all concrete, except non structural slabs-on-grade and sitework. Observe and report on placing method, consolidation, cold joints, length of drop and displacement of reinforcing. Report deficiencies to the Contractor immediately for corrective action. Inspections may be reduced to a periodic basis when all procedures have been deemed satisfactory by the laboratory.

J. The testing laboratory shall certify each delivery ticket indicating class of concrete delivered (or placed), amount of water added and the time at which the cement and aggregate was dispensed into the truck, and the time at which concrete was discharged from the truck.

3.4 Evaluation and Acceptance:

A. If the measured slump or air content of air entrained concrete falls outside the specified limits, a check test shall be made immediately on another portion of the same sample. In the event of a second failure, the concrete shall be considered to have failed to meet the requirements of the specifications, and shall be rejected.

B. The strength level of the concrete will be considered satisfactory if the averages of all sets of three consecutive strength test results are equal to or exceed the specified strength and no individual test result (average of two cylinders) is below the specified strength by more than 500 psi.

C. Completed concrete work will be accepted when the requirements of "Specifications for Structural Concrete for Buildings," ACI 301, Chapter 18 have been met.

D. Comply with ACI 311, "Guide For Concrete Inspection" and "ACI Manual of Concrete Inspection" (SP-2).

E. Inspect the application of curing compound and monitor all curing conditions to assure compliance with Specification requirements. Report curing deficiencies to the Contractor immediately and submit a report to the Architect.

3.5 TESTING OF NON-SHRINK GROUT

A. Make one strength test for every 10 base plates grouted and for every 10 bags of grout used in joints between members.

B. Each test shall consist of four cubes, two to be tested at seven days, and two at 28 days, made and tested in accordance with ASTM C109, with the exception that the grout shall be restrained from expansion by a top plate.

3.6 STRUCTURAL STEEL

A. Inspect all structural steel during fabrication and during and after erection for conformance with Contract Documents and shop drawings.

B. Shop Inspection:
   1. Examination of steel for straightness and alignment.
   2. Examination of all fabricated pieces for compliance with Contract Documents and shop drawings.
   3. Visual examination of all shop welding.
   4. Ultrasonic testing of all full penetration welds.
5. Examination of galvanizing.
6. Examination of installation of shop welded shear studs.
7. Examination of shop painting.

C. Field Inspection:
1. Proper erection of all pieces.
2. Proper installation of all bolts, including the checking of calibration of impact wrenches used with high strength bolts.
3. Plumbness of structure and proper bracing.
4. Field Painting.
5. Visual examination of all field welding.
6. Ultrasonic testing of all penetration welds.
7. Installation of field welded shear studs.
8. Measure and record camber of all beams upon arrival and before erection for compliance with the specified camber. Measure lying flat with web in horizontal position. Members outside specified camber tolerance shall be returned to the shop for remedial work.

D. Qualification of Welders: Fabricator and erector shall provide the testing laboratory with names of welders to be employed in the work, together with certification that welders have passed qualification tests within the last year using procedures specified in the AWS D1.1. Testing laboratory shall verify all welder's qualifications.

E. Inspection of shop and field welding shall be "verification inspection," in accordance with Section 6 of AWS D1.1 and as follows:
1. Visually inspect the welding of all shop fabricated members and note the location of all cover plates, connectors, bearing stiffeners, splices, and fillet welds for proper return around ends and check for seams, folds, and delaminations.
2. Ultrasonically test all penetration welds in accordance with AWS D1.1.
3. Inspect surfaces to be welded. Surface preparations, fit-up and cleanliness of surface shall be noted.
4. The welding inspector shall be present during alignment and fit-up of members being welded, and shall check for correct surface preparation of root openings, sound weld metal, and proper penetration in the root pass. Where weld has not penetrated completely, the inspector shall order the joint to be chipped down to sound metal, or gouged out and rewelded. Root passes shall be thoroughly inspected for cracks. All cracks shall be gouged out and rewelded to two inches beyond each end of crack.
5. The inspector shall check that all welds have been marked with the welders symbol. The inspector shall mark the welds requiring repairs and shall make a reinspection. The inspector shall maintain a written record of all welds. Work completed and inspected shall receive an identification mark by the inspector.
6. The testing laboratory shall advise the Owner and the Architect of any shop and/or field conditions which, in his opinion, may require further tests and examination by means other than those specified. Such further tests and examinations shall be performed as authorized by the Owner and the Architect.
7. The Owner reserves the right to use ultrasonic or radiographic inspection to verify the adequacy of all welds. Testing procedures and acceptance criteria shall be as specified in AWS D1.1.

F. Inspection of bolted construction shall be in accordance with AISC "Specification for Structural Steel Buildings" and as follows:
1. All bolts shall be visually inspected to ensure that the plies have been brought into snug contact.
2. High strength bolting shall be inspected in accordance with Section 9 of the AISC "Specifications for Structural Joints Using ASTM A325 or A490 Bolts."
3. For all high strength bolts, unless specifically noted on the Drawings to require only "snug-tight" installation, the inspector shall observe the required jobsite testing and calibration, and shall confirm that the procedure to be used provides the required tension.

4. For slip critical connections, inspect the contact surfaces for compliance with specifications prior to bolting.

G. Inspection of stud welding shall be in accordance with Section 7.8 of AWS D1.1 and as follows:

1. A minimum of two shear studs shall be welded at the start of each day’s production period in order to determine proper generator, control unit and stud welding setting. These studs shall be capable of being bent at 45 degrees from vertical without weld failure.

2. When the temperature is below 32 degrees Fahrenheit, one stud in each 100 shall be tested after cooling. Studs shall not be welded below zero degrees Fahrenheit or when the surface is wet due to rain, snow, or ice. If a stud fails, two new studs shall pass the test before resumption of the welding.

3. Visually inspect studs for compliance with the Contract Documents. Check number, spacing, and weld quality. If, after welding, visual inspection reveals that a sound weld or a full 360 degree fillet has not been obtained for a particular stud, such stud shall be struck with a hammer and bent 15 degrees off perpendicular. Studs failing this test shall be replaced.

3.7 EXPANSION BOLT INSTALLATION

A. Inspect the drilling of each hole and installation of each expansion bolt for compliance with the Contract Documents.

B. Verify the installation torque for each expansion bolt for compliance with manufacturer's installation instructions.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Temporary utilities.
   2. Field offices and sheds.
   3. Temporary controls.
   4. Protection of installed Work.
   5. Progress cleaning.
   6. Dust control.
   7. Removal

1.2 TEMPORARY ELECTRICITY

A. Connect to existing electrical system for electricity required during construction, or provide temporary power if none is available, or if existing is not adequate.

B. The County shall pay cost of electricity used from existing electric service.

C. Provide and pay for required service of capacity or characteristics other than that currently available.

D. Provide power outlets for construction operations, with branch wiring and distribution boxes located as required. Provide flexible power cords as required.

E. Maintain distribution system and provide routine repairs.

1.3 TEMPORARY LIGHTING

A. Provide temporary lighting for construction and security purposes.

B. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.

C. Maintain lamps and provide routine repairs.

1.4 TEMPORARY HEAT

A. Provide temporary heating devices required to maintain specified ambient temperatures for construction.

B. Maintain minimum ambient temperature of 50 degrees F in areas where construction is in progress, unless otherwise indicated in individual specification sections.

1.5 TEMPORARY VENTILATION

A. Ventilate enclosed areas to facilitate curing of materials, disperse humidity, and prevent accumulations of dust, fumes, vapors, or gases.

B. Provide temporary fan units as required to maintain clean air for construction.
1.6 TEMPORARY WATER
A. Connect to existing water source for water required for construction.
B. County shall pay costs of water used from existing water service.
C. Extend branch piping and provide temporary hoses so that water is available at locations needed for work.
D. Protect from freezing.
E. Maintain distribution system and provide routine repairs.

1.7 TEMPORARY SANITARY FACILITIES
A. Provide chemical toilets for use during construction.
B. Permanent toilets may not be used during construction.
C. Maintain facilities in clean and sanitary condition.

1.8 FIELD OFFICES AND SHEDS
A. Contractor may use space within the Annex or may provide temporary field offices and storage sheds required for construction.
B. Do not unreasonably encumber site or premises with excess materials or equipment.
C. Temporary Structures:
   1. Portable or mobile buildings, structurally sound, weathertight, with floors raised above ground.
   2. Temperature transmission resistance: Compatible with occupancy and storage requirements.
   3. Provide connections for utility services when required.
   4. Provide steps and landings at entrances.
D. Field Office:
   1. Size required for Contractor's use and to provide space for project meetings.
   2. Adequate electrical power, lighting, heating, and cooling to maintain human comfort.
   3. Provide facilities for storage of Project Record Documents.
   4. Provide computer with printer and e-mail connection.
   5. Maintain digital camera at site with capability to transmit photographs via e-mail.

1.9 BARRIERS
A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from construction operations.
B. Fencing:
   1. Provide temporary fencing for construction operations as required.
   2. Locate to protect stored materials and equipment.
C. Tree and Plant Protection:
   1. Protect existing trees and plants at site that are designated to remain.
   2. Remove roots and branches that interfere with construction. Employ qualified tree surgeon to remove and to treat cuts.
3. Provide temporary barriers to height of 6 feet around individual or groups of trees and plants.
4. Do not permit vehicular traffic, parking, storing of materials, dumping of harmful chemicals or liquids, or standing or continuously running water within root zones.
5. Supervise earthwork operations to prevent damage to root zones.
6. Replace trees and plants that are damaged or destroyed due to construction operations.

1.10 EXTERIOR CLOSURES

A. Provide temporary weathertight closures for exterior openings to provide acceptable interior working conditions, to allow for temporary heating and maintenance of ambient temperatures required in individual specification sections, to protect the Work, and to prevent entry of unauthorized persons.

B. Provide access doors with locking hardware.

1.11 PROTECTION OF INSTALLED WORK

A. Protect installed work from construction operations; provide special protection when required in individual specification sections.

B. The existing membrane roofing was installed under a previous project. Minimize traffic, storage, and construction activities on roof surfaces. If traffic, storage, or activity is necessary, obtain recommendations for protection from roofing manufacturer. At minimum, provide ½” thick plywood on 1 ½” thick rigid insulation at paths of travel.

C. Prohibit traffic from landscaped areas.

1.12 PROGRESS CLEANING

A. Maintain areas free from waste materials, debris, and rubbish. Maintain site in clean and orderly condition.

B. Provide containers for collection of waste materials, debris, and rubbish; remove and dispose of off site as required by construction activities.

C. Periodically clean interior areas to provide suitable conditions for finish work.

1.13 TEMPORARY CONTROLS

A. Dust Control:
   1. Provide dust control materials and methods to minimize dust from construction operations.

1.14 REMOVAL

A. Remove temporary utilities, equipment, facilities, and services when construction needs can be met by use of permanent construction or upon completion of Project.

B. Clean and repair damage caused by installation or use of temporary work.

C. Restore existing and permanent facilities used during construction to original or to specified condition.

PART 2 - PRODUCTS

2.1 Not used.
PART 3 - EXECUTION

3.1 Not used.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Products.
   2. Transportation and handling.
   3. Storage and protection.
   4. Reuse of existing materials.
   5. Product options.

1.2 PRODUCTS

A. Provide interchangeable components by the same manufacturer for identical items.

B. Do not reuse materials and equipment removed from existing construction in completed Work, except as specifically permitted by the Contract Documents.

1.3 TRANSPORTATION AND HANDLING

A. Coordinate delivery of Products to prevent conflict with Work and adverse conditions at site.

B. Transport and handle Products in accordance with manufacturer's instructions.

C. Promptly inspect shipments to ensure that Products comply with requirements of Contract Documents, are undamaged, and quantities are correct.

D. Provide equipment and personnel to handle products by methods to prevent damage.

1.4 STORAGE AND PROTECTION

A. Store and protect Products in accordance with manufacturer's instructions with manufacturer's seals and labels intact and legible.

B. Store Products on site unless prior written approval to store off site has been obtained from Owner.

C. Store Products subject to damage by elements in weathertight enclosures. Maintain temperature and humidity within ranges required by manufacturer's instructions.

D. Exterior Storage:
   1. Store fabricated Products above ground; prevent soiling and staining.
   2. Cover products subject to deterioration with impervious sheet coverings; provide ventilation to prevent condensation.
   3. Store loose granular materials in well drained area on solid surfaces; prevent mixing with foreign matter.

E. Arrange storage areas to permit access for inspection. Periodically inspect stored products to verify that products are undamaged and in acceptable condition.
1.5 PRODUCT OPTIONS

A. Products specified by reference standard only:
   1. Select any Product meeting the specified standard.
   2. Submit Product Data to substantiate compliance of proposed Product with specified requirements.

B. Products specified by naming two or more acceptable Products: Select any named Product.

C. Products specified by stating that the Contract Documents are based on a Product by a single manufacturer followed by the statement "Equivalent products by the following manufacturers are acceptable":
   1. Select the specified Product or a Product by a named manufacturer having equivalent or superior characteristics to the specified Product and meeting the requirements of the Contract Documents.
   2. If the specified Product is not selected, submit Product Data to substantiate compliance of proposed Product with specified requirements.
   3. The specified Product establishes the required standard of quality.

D. Products specified by naming one or more Products followed by "or approved substitute" or similar statement:
   1. Submit a Substitution Request Form for Products not listed.
   2. The specified Product establishes the required standard of quality.

E. Products specified by naming one or more Products or manufacturers followed by the statement "Substitutions: Under provisions of Division 1":
   1. Submit a Substitution Request Form for Products not listed.
   2. The specified Product establishes the required standard of quality.

F. Products specified by naming one Product followed by the statement "Substitutions: Not permitted": Substitutions will not be allowed.

G. Products specified by required performance or attributes, without naming a manufacturer or Product:
   1. Select any Product meeting specified requirements.
   2. Submit Product Data to substantiate compliance of proposed Product with specified requirements.

1.6 SUBSTITUTIONS

A. Do not substitute Products unless a Substitution Request Form has been approved by the Architect.

B. Substitutions during Bidding: Refer to Instructions to Bidders.

C. Architect will consider Substitution Requests within 30 days after award of Contract. After initial 30 day period, Substitutions Requests will be considered only due to non-availability of a specified Product.

D. In case of non-availability of a specified Product notify Architect in writing as soon as non-availability becomes apparent.

E. Submit Substitution Requests using Substitution Request Form provided by Architect. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents, including:
   1. Product identification, including name and address of manufacturer.
3. Sample, if requested.
4. Description of any anticipated effect that acceptance of proposed Substitution will have on Progress Schedule, construction methods, or other items of Work.
5. Description of any differences between specified product and proposed Substitution.

F. Submit one electronic copy. Architect will return to Contractor for printing and distribution.

G. A request constitutes a representation that the Contractor:
   1. Has investigated the proposed Product and determined that it meets or exceeds the quality level of the specified Product.
   2. Will provide the same warranty for the Substitution as for the specified Product.
   3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.
   5. Will reimburse Owner for design services associated with re-approval by authorities or revisions to Contract Documents to accommodate the Substitution.

H. Substitutions will not be considered if:
   1. They are indicated or implied on Shop Drawings or other submittals without submittal of a Substitution Request Form.
   2. Approval will require substantial revision of Contract Documents without additional compensation to Architect.

I. Approved substitutions will be incorporated into Contract Documents by Change Order.

PART 2 - PRODUCTS

2.1 Not used.

PART 3 - EXECUTION

3.1 Not used.

END OF SECTION
DATE:  

TO:  

ATTENTION:  

PROJECT:  

We submit for your consideration the following product as a Substitution for the specified product:

<table>
<thead>
<tr>
<th>Section No.</th>
<th>Paragraph</th>
<th>Specified Product</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Proposed Substitution:  

Reason for Substitution:  

Product Data:

Attach complete technical data for the proposed Substitution. Include information on changes to Contract Documents that the proposed Substitution will require for its proper installation.

Samples:  

[ ] Attached [ ] Will be furnished upon request

Does the Substitution affect dimensions shown on Drawings?

[ ] No [ ] Yes (explain)

Effects of proposed Substitution on other Work:

Differences between proposed Substitution and specified Product:
Manufacturer’s warranties of the proposed Substitution and specified Products are:

[ ] Same  [ ] Different (explain) ______________________________________________________

Maintenance service and spare parts are available for proposed Substitution from:

____________________________________________________________________________________

____________________________________________________________________________________

Previous installations where proposed Substitution may be seen:

Project: _________________________________  Project: _________________________________
Owner: _________________________________  Owner: _________________________________
Architect: ________________________________  Architect: ________________________________
Date Installed: ____________________________  Date Installed: _____________________________

Cost savings to be realized by Owner, if proposed Substitution is approved:

____________________________________________________________________________________

Change to Contract Time, if proposed Substitution is approved:

[ ] No Change  [ ] Add ________ days  [ ] Deduct ________ days

Submittal constitutes a representation that Construction Manager has read and agrees to the provisions of Section 01 60 00.

Submitted By Construction Manager:

__________________________________________
Signature

____________________________________________________________________________________
Firm

For Use by Architect:

Based on the information supplied by the Construction Manager, the Architect has reviewed the proposed Substitution on the basis of design concept of the Work and conformance with information given in Contract Documents.

[ ] Approved  [ ] Approved as Noted  [ ] Rejected

[ ] Submit Additional Information: ______________________________________________________

By: ________________________________  Date: ______________________

END OF SECTION
SECTION 01 73 20
CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements and limitations for cutting and patching of new work.

B. Execute cutting to include excavating, fitting, and patching of 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 Contract Documents.
   5. Provide routine penetrations of nonstructural surfaces for installation of piping and electrical conduit.
   6. Interface new and existing work.

1.2 SUBMITTALS

A. Submit written request in advance of executing cutting or alteration that affects:
   1. Work of Owner or separate contractor.
   2. Structural integrity of project.
   3. Integrity or effectiveness of weather exposed or moisture resistant elements or systems.
   4. Efficiency, operational life, maintenance, or safety of operational elements.
   5. Visual qualities of sight exposed elements.

B. Include in Request:
   1. Identification of project.
   2. Description of work affected.
   3. Necessity for cutting or patching.
   4. Effect of cutting or patching on work of Owner or separate contractor, or on structural, weatherproof, or visual integrity of project.
   5. Description of proposed work:
      a. Scope of cutting and patching.
      b. Contractor and trades to execute work.
      c. Products proposed to be used.
      d. Extent of refinishing.
   6. Alternate to cutting and patching.
   7. Cost proposal, if applicable.
   8. Written permission of any separate contractor whose work will be affected.

C. If conditions of work or schedule necessitate a change of material from that originally installed, submit written request in accordance with Section 01 60 00.

D. Submit written notice to Architect designating time work will be uncovered, to allow for observation.
1.3 PREPARATION
   A. Examine existing conditions of work, including elements subject to movement or damage during cutting and patching.
   B. After uncovering work, examine conditions affecting installation of new products or performance of work.
   C. Provide protection for other portions of project.
   D. Provide protection from elements.

1.4 CUTTING AND PATCHING
   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 that will prevent damage to other work, and will provide proper surfaces to receive installation of repairs and new work.
   C. Execute excavating and backfilling by methods that will prevent damage to other Work, and will prevent settlement.
   D. Employ original installer or fabricator to perform cutting and patching for:
      1. Weather exposed or moisture resistant elements.
      2. Sight exposed finished surfaces.
   E. Restore work that has been cut or removed; install new products to provide completed Work in accordance with requirements of Contract Documents.
   F. Refinish entire surfaces as necessary to provide an even finish:
      1. Continuous surfaces: To nearest intersections.
      2. Assembly: Refinish entirely.

PART 2 - PRODUCTS

2.1 Not used.

PART 3 - EXECUTION

3.1 Not used.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Closeout procedures.
   2. Final cleaning.
   3. Adjusting.
   4. Project record documents.
   5. Operation and maintenance data.
   7. Spare parts and maintenance materials.
   8. Demonstration and instructions.

B. Related Sections:
   1. Section 01 50 00 - Construction Facilities and Temporary Controls: Progress cleaning.

1.2 CLOSEOUT PROCEDURES

A. Final Inspection:
   1. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with the Contract Documents and ready for inspection by the Architect.
   2. If Architect performs re-inspection due to failure of Work to comply with claims of status of completion made by Contractor, Owner will compensate Architect for such additional services and will deduct the amount of such compensation from final payment to the Contractor.

B. Submit final Application for Payment showing original Contract Sum, adjustments, previous payments, retainage withheld from previous payments, and sum remaining due.

C. Closeout Submittals:
   1. Evidence of compliance with requirements of governing authorities.
   2. Construction photographs.
   3. List of subcontractors and suppliers, indicating firm name, area of responsibility or specialty, address, and telephone number.
   4. Project Record Documents.
   5. Operation and Maintenance Data.
   7. Spare parts and maintenance materials.
   8. Evidence of payment to Subcontractors and suppliers.
   10. Certificate of insurance for products and completed operations.

1.3 FINAL CLEANING

A. Execute final cleaning prior to final inspection.
B. Clean debris from roofs and drainage systems

C. Clean site affected by the work.

D. Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.4 ADJUSTING

A. Adjust operating Products and equipment to ensure smooth and unhindered operation.

1.5 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other Modifications to the Contract.
   5. Reviewed Shop Drawings, Product Data, and Samples.

B. Store Record Documents separate from documents used for construction.

C. Record information concurrent with construction progress.

D. Specifications: Legibly mark and record at each Product section description of actual Products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and Modifications.

E. Record Documents and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Field changes of dimension and detail.
   2. Details not on original Contract Drawings.

F. Material Safety Data Sheets:
   1. Maintain copies of manufacturer's Material Safety Data Sheets for each Product incorporated into the Work.
   2. Indicate manufacturer name, product name, chemical composition, hazards, and safety and health procedures.
   3. Assemble in three ring binder with durable plastic cover.
      a. Prepare binder covers with printed title "MATERIAL SAFETY DATA SHEETS" and title of project.
      b. Organize contents according to Project Manual table of Contents.
      c. Provide typed table of contents.

G. Prior to Substantial Completion transfer marks made during construction to one set of reproducible transparency prints.

H. Submit one copy of Project Record Documents to Architect for review, along with final Application for Payment.

I. After Architect has approved Project Record Documents, submit following copies:
1. Architect:
   a. Drawings: One half size set of blackline prints.
   b. Specifications: One 8-1/2 x 11 inch set.
   c. One Electronic set of drawings and specifications
2. Owner:
   a. Drawings: One full size set and one half size set of blackline prints.
   b. Specifications: One 8-1/2 x 11 inch set.
   c. One Electronic set of drawings and specifications

1.6 OPERATION AND MAINTENANCE DATA

A. Provide two copies, 8-1/2 x 11 inches text pages, bound in three ring binders with durable plastic covers.

B. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.

C. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

D. Contents:
   1. Directory: List names, addresses, and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.
   2. Operation and maintenance instructions: Arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Parts list for each component.
      d. Operating instructions.
      e. Maintenance instructions for equipment and systems.
      f. Maintenance instructions for special finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.
   3. Project documents and certificates including:
      a. Shop drawings and product data.
      b. Air and water balance reports.
      c. Certificates.
      d. Photocopies of warranties and bonds.

E. Submittal:
   1. Submit one copy of completed volumes in final form 15 days prior to final inspection.
   2. Architect will notify Contractor of any required revisions after final inspection.
   3. Revise content of documents as required prior to final submittal.
   4. Submit revised volumes within 10 days after final inspection.

1.7 WARRANTIES

A. Provide two copies of each warranty.
B. Execute and assemble documents from Subcontractors, suppliers, and manufacturers.

C. Provide Table of Contents and assemble in three ring binder with durable plastic cover.

D. Submit prior to final Application for Payment.

E. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within 10 days after acceptance, listing date of acceptance as start of warranty period.

1.8 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification Sections.

B. Deliver to Project site in location as directed; obtain receipt prior to final payment.

1.9 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of Products to Owner's personnel two weeks prior to date of Substantial Completion.

B. Utilize Operation and Maintenance Manuals as basis for instruction. Review contents of manual with Owners' personnel in detail to explain all aspects of operation and maintenance.

C. Demonstrate startup, operation, control, adjustment, troubleshooting, servicing, maintenance, and shutdown of each item of equipment at agreed upon times, at equipment location.

D. Prepare and insert additional data in Operation and Maintenance Manuals when need for additional data becomes apparent during instruction.

PART 2 – PRODUCTS

2.1 Not used.

PART 3 - EXECUTION

3.1 Not used.

END OF SECTION
SECTION 02 41 19
SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Removal of designated building construction.
   2. Identification of utilities.

1.2 SUBMITTALS

A. Shop Drawings: Indicate areas for demolition, removal sequence and location of salvageable items, and location and construction of temporary work.

1.3 REGULATORY REQUIREMENTS

A. Conform to applicable code for demolition work, safety of structure, and dust control.
B. Obtain required permits from authorities.
C. Notify affected utility companies before starting work and comply with their requirements.
D. Conform to applicable codes when hazardous or contaminated materials are discovered.
E. Do not close or obstruct exits.

1.4 PROJECT CONDITIONS

A. Minimize interference with streets, walks, other public right-of-ways, and adjacent facilities.
B. If hazardous materials are discovered, notify Owner and Architect and await instructions. Refer to Asbestos Abatement Specifications in the Appendix of the Project Manual for scope of abatement work under this Contract.
C. If any of the following conditions are encountered, cease work immediately, notify Architect, and await instructions:
   1. Structure is in danger of movement or collapse.
   2. Materials or conditions encountered differ from those designated in the Contract Documents.

PART 2 - PRODUCTS

2.1 Not used.

PART 3 - EXECUTION

3.1 PREPARATION

A. Erect temporary partitions, barricades, warning devices, and controls.
B. Provide protective coverings, shoring, bracing, and supports for construction designated to remain.
C. Coordinate temporary disconnection of utilities as required with the Owner.

3.2 DEMOLITION

A. Remove existing construction to extent indicated and as necessary to join new work to existing. Do not remove more than is necessary to allow for new construction.

B. Do not damage work designated to remain.

C. Minimize noise and spread of dirt and dust.

D. Assign work to trades skilled in procedures involved.

E. Remove and dispose of waste materials off site.

END OF SECTION
SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Concrete formwork, reinforcement, accessories, finishing, and curing
B. Elevated Slabs
C. Floors and slabs on grade
D. Ramps
E. Miscellaneous concrete elements, including equipment pads, sign pole foundations, etc.

1.02 RELATED SECTIONS

A. Section 06 10 00 – Rough Carpentry
B. Section 10 14 23 – Signage for sign post footings.
C. Section 32 16 23 – Portland Cement Concrete Paving for sidewalks, curb ramps, curbs and gutters.

1.03 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301.
B. Acquire cement from same source and aggregate from same source for entire project.
C. Follow recommendations of ACI 305R when concreting during hot weather.
D. Follow recommendations of ACI 306R when concreting during cold weather.
E. Submit photos of reinforcement placement to the Engineer 24 hours prior to concrete placement.

1.04 SUBMITTALS

A. The mix design, performed within the last six months by an independent testing laboratory or concrete supplier, which meets the requirements of this Specification.
B. The mix design shall include:
   1. Proportioning of all materials.
   2. Slump.
   3. Air entrainment.
   4. 7 and 28-day compressive strength historical data.
   5. Sieve analysis and source of fine and coarse aggregates.
C. Furnish engineer with copies of batch tickets for each batch of concrete delivered to job-site.

PART 2 - PRODUCTS

2.01 FORM MATERIALS

A. Unless otherwise shown or specified, construct formwork for exposed concrete surfaces with plywood, to provide continuous, straight, smooth, exposed surfaces.

B. Below-grade footings may be earth-formed, provided that the sides and bottom of the footing trench are cut clean and debris and loose soil are removed before placement.

2.02 REINFORCING MATERIALS

A. Reinforcing bars and dowels: ASTM A 615 Grade 60.

B. Bar Supports: Furnish and install in accordance with Concrete Reinforcing Steel Institute "Manual of Standard Practice," unless detailed otherwise on the drawings.

2.03 CONCRETE MATERIALS

A. Cement: Conform to ASTM C 150, Type I.

B. Fine and Coarse Aggregates: ASTM C 33

C. Water: Clean and not detrimental to concrete.

D. Admixtures:
   3. Admixtures shall be from one manufacturer and must be compatible when mixed together.

2.04 RELATED MATERIALS

A. Tie Wire: No. 18 gauge soft annealed wire.

B. Curing Compound: shall not be used.

C. Expansion Joints: Asphalt impregnated fiberboard or redwood.

D. Joint sealant shall conform to the requirements of ASTM D5893-96 “Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements”

2.05 CONCRETE MIX DESIGN

A. Mix and transport concrete in accordance with ASTM C 94/ C 94M.

B. Provide concrete for placement of the following characteristics unless noted otherwise:
   1. Compressive Strength: as noted on the drawings
2. Maximum Water/Cement Ratio 0.45
3. Air Content: 4 percent, per ASTM C 173
4. Maximum Slump: 3 inches

C. Use acceleration or set-retarding admixtures only when approved by Engineer.

PART 3 - EXECUTION

3.01 FORMS
A. Provide forms in good condition. Brace and tie together to maintain position and shape during placement and vibration of concrete. Forms shall be sufficiently tight to prevent the leakage of mortar.

3.02 PREPARATION
A. Remove water from the forms and excavations before any concrete is deposited. Divert any flow of water to prevent washing of freshly deposited concrete. Remove all debris from the space to be occupied by the concrete.

B. Immediately in advance of placing concrete, excavations, forms, reinforcement, inserts, etc. will be inspected by the Engineer. If any part of the work is determined to be unsatisfactory, do not proceed with the concrete work until all defects have been remedied and the approval of the Engineer has been obtained.

3.03 INSTALLING REINFORCEMENT
A. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve no less than minimum concrete coverage required for protection.

B. Place reinforcement accurately in position and securely fasten and support to prevent displacement during the placing of the concrete.

C. Provide concrete minimum cover protection for reinforcement of 3 inches for below-grade concrete and 2 inches otherwise. Provided standard spacers as needed.

3.04 PLACING CONCRETE
A. Place concrete in accordance with ACI 301/ 304R. Ensure reinforcement, inserts, embedded parts, and formed joints are not disturbed during concrete placement.

B. Thoroughly wet the forms or subgrade with clean water immediately before placement.

C. Do not chute concrete more than fifteen feet. Restrict free fall of concrete to three feet, maximum.

D. Use vibrator to consolidate concrete.

E. Strike off and screed concrete to produce a section that is thoroughly compacted and finished to the specified line, grade and cross-section.

F. Install transverse construction joints at the end of each day's placing operations and at any other time when concrete placement is interrupted for sixty minutes or longer.
G. All concrete not placed within ninety minutes after mixing will be rejected and is to be disposed of off site by the Contractor at his own expense.

H. Concrete that has developed initial set before placement will be rejected and disposed of by the Contractor at his own expense.

I. Concrete with a temperature of more than 90 degrees Fahrenheit prior to placement will be disposed of off site by the Contractor at his own expense.

J. Any time that the air temperature reaches 35 degree Fahrenheit and is falling, placement of concrete shall cease. All concrete placed within the previous 72 hours shall be immediately protected.

K. Contractor is to bear the cost of all concrete rejected by the Engineer and all cost associated with transportation and disposal.

3.05 JOINTS

A. Where shaped sealant/control joints are required in topping, form joints by tooling. Alternatively, control joints shall be saw cut after finishing. Joints shall be completed within four hours after the concrete has been placed.

3.06 CONCRETE FINISHES

A. Trowel Finish: consolidate concrete surface by final machine and/or hand-troweling operation. The final surface shall be free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding 1/8-inch in 10 feet when tested with 10 foot straightedge.

B. Broomed Finish: apply non-slip broomed finish to surfaces that will be exposed to vehicular traffic. While the concrete is still workable, produce a brush surface finish. Work surface with an approved brush to produce a uniformly textured surface.

3.07 CURING

A. Cure concrete by moist curing for a period of not less than 72 hours from the end of finishing operations. During moist curing, the surface of the concrete shall not be allowed to dry.

END OF SECTION
SECTION 04 01 19
CHEMICAL CLEANING OF MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Power wash exterior masonry 100% with low to medium pressure water spray.
   2. Remove white staining on brick masonry below cast stone panels with solution of water and mild detergent and soft bristle brush. If cleaning with mild detergent is not successful use chemical cleaning systems specified.

B. Related Sections:
   1. Division 1: Administrative, procedural, and temporary work requirements.
   2. Section 04 05 20 - Masonry Restoration.

1.2 DESCRIPTION OF WORK

A. Masonry cleaning, in scheduled areas, shall be completed prior to the removal or repair of deteriorated masonry. After the masonry has been cleaned, it shall be protected from dirt and staining for the remainder of the project.

B. The goal of the work of this Section is to remove all stains, atmospheric dirt, and other residue from all exposed masonry surfaces of the building scheduled for cleaning and to give the facade a clean, uniform appearance without blotches, streaks, runs or other kinds of spotty appearance. Any work that does not achieve this goal will be considered unsuccessful and will have to be re-cleaned until this goal is achieved, at no additional cost to the Owner.

1.3 DEFINITIONS

A. Pressure Spray:
   1. Low-Pressure Spray: 100 to 400 psi; 4 to 6 gpm.
   2. Medium-Pressure Spray: 400 to 800 psi; 4 to 6 gpm.
   3. High-Pressure Spray: 800 to 1200 psi; 4 to 6 gpm.

1.4 SUBMITTALS

A. Product Data: Include product description, application procedures, precautions, and limitations in use of products.

B. Contractor is responsible for proper disposal of all waste and cleaning materials.

C. Submit, for Owner review, a letter of acceptance from local regulatory entities (such as Storm or Sanitary Sewer Departments) indicating that procedure for disposal of cleaning effluent is compliant with relevant rules and regulations.

1.5 QUALITY ASSURANCE

A. Applicator:
   1. Minimum 3 years documented experience in work of this Section.
   2. Successful completion of at least 3 projects of similar scope and complexity within past 5 years.
B. Mockups:

1. Control Test Sample: Upon approval of product data and methods, prepare cleaning sample(s) approximately 10 square feet for each type of masonry and surface condition and for each type of cleaning product or water mist method proposed for use in locations approved by the Architect.
   a. Allow cleaning solutions to remain on surface for varying time periods in several locations to determine optimum time required.
   b. Perform multiple applications of varying concentrations of cleaning solutions to determine optimum concentration.
   c. Ensure that materials and procedures will not discolor or damage existing surfaces.

2. Allow a waiting period of not less than 7 days after completion of sample cleaning to permit a study of sample panels for negative reactions.

C. Miscellaneous

1. Methods of Application: Submit a written description of the full range of methods and procedures proposed for cleaning and stain removal including but not limited to: method of application, dilution of application, temperature of application, length of time of surface contact, method of rinsing surface (temperature, pressure, and duration), repetition of procedure, etc.

2. Methods of Protection: Submit a written description of proposed materials and methods of protection for preventing damage to any non-masonry surfaces in proximity to this work, including glass and metals. These methods and materials may include, but are not limited to, spray-on, peel-off type liquid materials and masking tape. Outline methods proposed to keep water from reaching the interior of the building.

3. If materials and methods other than those indicated are proposed for cleaning work, provide a written description, including evidence of successful use on other comparable projects, and a testing program to demonstrate their effectiveness for this Project.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer’s original sealed and labeled containers.

B. Store all materials in accordance with manufacturer’s recommendations and free from extremes of temperature.

1.7 PROJECT CONDITIONS

A. Clean stone surfaces only when air temperature is 50 deg F (10 deg C) and above and will remain so for at least 7 days after completion of cleaning.

B. Do not perform work when wind could carry materials to adjacent or underlying materials, or to adjacent property.

C. Perform all work of this Section in accordance with all Federal, State and local regulations regarding the transportation, storing, handling, application, removal and disposal of the products involved.

D. Protect workers and public from injury during this work. Provide all required temporary partitions, closures, guards, notices, and the like.

E. Protect the site and adjoining property, including vehicles, from damage that may result from this work. Trees and plants around the building shall be protected from contamination.

F. Take all measures required to ensure that the building remains completely watertight throughout the course of this work.
G. Repair damage to the building caused by penetration of water, or other factors resulting from failure to properly protect the building during work of this Section. Repairs shall be completed at no additional cost to the Owner, in a manner that fully restores all affected elements to their condition prior to damage.

PART 2 - PRODUCTS

2.1 GENERAL

A. Masonry cleaning materials used in this work shall be part of a system of products produced by one manufacturer, where possible, to ensure compatibility.

B. All materials shall be manufactured for the purpose in which they are proposed for use.

C. All chemical materials, compounds, liquids, etc. shall be safe and shall not violate state or federal environmental or safety regulations.

D. Injurious substances or any ingredients that independently or in combination with other compounds, fluids or solutions will damage masonry shall not be used. Methods or products causing abrasion or similar damage to the surface finish of the masonry shall not be used.

E. No sand, silica flour, or any other grit shall be used either singly or in combination with pressurized air, water or any other liquid.

2.2 CHEMICAL CLEANING SYSTEM FOR BRICK

A. Description: Manufacturer’s all surface cleaner and degreaser for light-to-heavily soiled masonry that contains no harsh acids, caustics or solvents.

   1. Cleaning System: SureKlean 2010 All Surface Cleaner, as manufactured by PROSOCO, Inc., 3741 Greenway Circle, Lawrence, KS 66046. Phone: (800) 255-4255

B. Dilute chemical cleaners with water to produce solutions not exceeding concentrations recommended by chemical cleaner manufacturer.

C. If additional spot cleaning or a more thorough cleaning after use of the SureKlean 2010 product is required to remove dirt, grime, grease, etc. utilize the product below

   1. Cleaning System:
      a. Option 1: SureKlean Light Duty Concrete Cleaner, as manufactured by PROSOCO, Inc., 3741 Greenway Circle, Lawrence, KS 66046. Phone: (800) 255-4255.
      b. Option 2: SureKlean Vana Trol, as manufactured by PROSOCO, Inc., 3741 Greenway Circle, Lawrence, KS 66046. Phone: (800) 255-4255.

2.3 CHEMICAL CLEANING SOLUTIONS FOR EXTERIOR MASONRY

A. Dilute chemical cleaners with water to produce solutions not exceeding concentrations recommended by chemical cleaner manufacturer.

B. Acidic Cleaner Solution for Brick: Dilute with water to produce hydrofluoric acid content of 3 percent or less, but not greater than that recommended by chemical cleaner manufacturer.

2.4 CLEAN MATERIALS AND EQUIPMENT

A. Water for Cleaning: Potable.
B. Warm Water: Heat water to a temperature of 140 to 160 deg. F (60 to 71 deg. C).

C. Liquid Strippable Masking Agent: Manufacturer’s standard liquid, film-forming, strippable masking material for protecting glass, metal, and polished stone surfaces from damaging effects of acidic and alkaline masonry cleaners.

1. Products: Sure Klean Strippable Masking, as manufactured by PROSOCO, Inc., 3741 Greenway Circle, Lawrence, KS 66046. Phone: (800) 255-4255; Fax: (785) 830-9797.

D. Spray Equipment:
1. Provide equipment for controlled spray application of water and chemical cleaners, at rates indicated for pressure, measured at spray tip, and for volume. Adjust pressure and volume, as required, to ensure that damage to masonry does not result from cleaning methods.
   a. Pressure not to exceed 400 psi for limestone.
   b. For water spray application, provide a fan-shaped spray tip that disperses water at an angle of not less than 15 degrees.
   c. For heated water spray application, provide equipment capable of maintaining a temperature at flow rates indicated between 140 and 160 deg F (60 and 71 deg. C)
   d. For chemical cleaner spray application, provide low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with a con-shaped spray tip.

PART 3 - EXECUTION

3.1 PREPARATION
A. General: Comply with chemical cleaner manufacturer’s written instructions for protecting building surfaces against damage from exposure to their products.

B. Protect persons, motor vehicles, surrounding surfaces of building being restored, building site, plants, and surrounding buildings from injury from masonry cleaning work.
1. Do not clean masonry during winds of sufficient force to spread cleaning solutions to unprotected surfaces.
2. Neutralize and collect alkaline and acid wastes. Dispose of runoff from cleaning operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.

3.2 CLEANING MASONRY, GENERAL
A. Proceed with cleaning in an orderly manner, work from bottom to top of each scaffold width and from one end of each elevation to the other.

B. Use only those cleaning methods indicated for each masonry material and location.
1. Use natural-fiber brushes only.
2. Use spray equipment that provides controlled application at volume and pressure indicated, measured at spray tip. Adjust pressure and volume to ensure that cleaning methods do not damage masonry.
   a. Equip units with pressure gages.

C. Perform each cleaning method indicated in a manner that results in uniform coverage of all surfaces, including corners, moldings, and interstices, and that produces an even effect without streaking or damaging masonry surfaces.
D. Chemical Cleaner Application Methods: Apply chemical cleaners to masonry surfaces to comply with chemical cleaner manufacturer's written instructions.
   1. Reapplying Chemical Cleaners: Do not apply chemical cleaners to same stone surfaces more than twice.
E. Rinse off chemical residue and soil by working upward from bottom to top of each treated area at each stage or scaffold setting.

3.3 CHEMICAL CLEANING MASONRY
A. Remove dirt, hydrocarbons, grease, oil, environmental pollutants, applied coatings, rust stains, and residues.
B. Sandblasting and the use of non-proprietary acids are prohibited.
C. Follow manufacturer's instructions and procedures established during preparation of mockups.
D. Working from bottom to top, prewet the surface with clean water.
E. Apply cleaning solution using synthetic roller, soft-bristled brush or spray applicator. Work into surface voids and irregularities.
F. Allow solution to stand on surfaces as recommended by Chemical Cleaning Manufacturer and as established by approved mock-ups. Do not allow to dry; reapply as necessary.
G. Gently scrub heavily soiled surfaces with medium hard bristle brush.
H. Working from bottom to top, rinse surfaces with medium pressure water. Hold nozzle perpendicular to surface; work at uniform rate and uniform distance from surface.
I. Repeat process if required until masonry is clean.
J. Do not damage existing surfaces. Leave surfaces uniform in appearance.

3.4 FINAL CLEANING
A. Contractor shall repeat the processes of the work of this Section until the goal of a clean, uniform surface is achieved.
B. Do not use acidic or alkaline cleaners for final cleaning.

END OF SECTION
SECTION 04 01 20

MASTERY RESTORATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Selective re-pointing of brick mortar joints.
   2. Removal and replacement of expansion joints in brick veneer and between cast stone panels 100%.
   3. Replacement of damaged or missing brick.
   4. Patching damaged brick, small holes only (Max. 1 1/2” diameter).
   5. Patching damaged cast stone panels.

B. Related Sections:
   1. Division 1: Administrative, procedural, and temporary work requirements.
   2. Section 04 05 13 - Restoration Mortar for pointing mortar.
   3. Section 04 01 19 – Chemical Cleaning of Masonry.
   4. Section 07 62 00 – Sheet Metal Flashing and Trim for metal counterflashing.
   5. Section 07 92 00 – Joint Sealers for sealing expansion joints between masonry and sealing joints between masonry and non-masonry materials.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   2. C 170 - Compressive Strength of Natural Building Stone.
   3. C 295 - Petrographic Examination of Aggregates for Concrete.


1.3 DEFINITIONS AND GOALS

A. Defective/Deteriorated Joint: Joints in which mortar is missing, loose, eroded, cracked, powdered, unsound, or weathered more than 1/8 inch from original plane.

B. Patching: The goal of patching is to remove areas of deteriorated stone from individual units and recreate missing lines, forms and shapes with a compatible material that has the color and texture of the original stone.

C. Re-pointing: The process of raking out (removing) mortar and replacing it with new mortar.
1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical data for each product indicated including recommendations for their application and use. Include test reports and certifications substantiating that products comply with specified requirements. Submit Material Safety Data Sheets for each product proposed for use.

B. Samples: Submit, for verification purposes, prior to mock-up erection, three samples each of the following:
   1. Each type of cementitious patching material (Brick and cast stone), applied to a 12 inch by 12 inch plywood panel, showing range of color and proposed texture.
   2. Face brick samples for each type of brick required, showing the full range of exposed colors, textures, and dimensions to be expected in the completed work.

C. Qualification Statement: Restorer qualifications, including previous projects.

1.5 QUALITY ASSURANCE

A. Restoration Specialist:
   1. Work of this Section must be performed by an experienced stone restoration firm that has completed work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance, having not less than 5 years comparable experience.
   2. Field Supervision: Restoration specialist firm shall maintain an experienced full-time supervisor on the Project site during times that masonry restoration work is in progress.

B. Field-Constructed Mock-ups: Contractor shall prepare the following sample panels on the building where directed by the Architect. Obtain Architect's acceptance of visual qualities before proceeding with the work. Retain accepted panels in undisturbed condition as a standard for judging completed
   1. Stone patching demonstrating removal of damaged cast stone and installation and curing of specified patching mortar.
   2. Brick repair, demonstrating removal and replacement of damaged brick.
   3. Brick patching demonstrating installation and curing of specified patching mortar.
   4. Brick re-pointing: Prepare two samples in-situ of approximately 2 feet high by 2 feet wide of brick re-pointing. One for demonstrating methods and quality of workmanship expected in removal of mortar from joints and the other for demonstrating visual qualities of pointing mortar and workmanship expected in pointing mortar joints.
   5. Removal and replacement of expansion joint sealant. Provide two mock-ups in-situ, approximately 2-feet long. One for demonstrating methods for full removal of the sealant and backing and preparation of the joint and the other for demonstration visual qualities of sealant application.

1.6 PROJECT CONDITIONS

A. Environmental Requirements:
   1. Hot weather requirements: If ambient temperature is over 95 degrees F or relative humidity is less than 50 percent, protect from direct sun and wind exposure for minimum 48 hours after installation.

B. Cold weather requirements:
   1. In accordance with IMIAC requirements.
   2. Do not use frozen materials or build upon frozen work.
1.7 SEQUENCING/SCHEDULING

A. Perform masonry restoration work in a logical sequence. Submit a plan sequencing for the following items of work:
   1. Masonry cleaning, specified under Section 04 01 19.
   2. Brick and cast stone patching.
   3. Re-pointing defective and or deteriorated stone masonry joints.
   4. Removal and replacement of brick and cast stone expansion joints.
   5. Resealing open and or deteriorated sealant joints, specified under Section 07 92 00.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver masonry restoration materials to site in manufacturer’s original and unopened containers and packaging, bearing labels as to type and names of products and manufacturer’s.

B. Protect masonry restoration materials during storage and construction from wetting by rain, snow or ground water, and from staining or intermixture with earth or other types of materials.

C. Comply with manufacturer’s recommendations for minimum and maximum temperature requirements for storage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers - Patching Compound:
   1. Cathedral Stone Products.
   2. Edison Coatings.

B. Acceptable Manufacturers - Injection Grout:
   1. Cathedral Stone Products.
   2. Edison Coatings.


2.2 CAST STONE PATCHING MATERIALS

A. Cementitious Patching Materials: Premixed cementitious patching material formulated to match the color and texture of the existing masonry. One-component, non-sag, mineral-based mortar, containing no synthetic polymers or additives for repair and reconstruction of natural stone surfaces. The mortar must be vapor permeable, frost and salt resistant, shrink resistant, and be physically compatible with the substrate, including, but not limited to porosity, tensile and compressive strength.

   1. Product: Jahn M90 Concrete Patching Mortar, as manufactured by Cathedral Stone Products, Inc., Jessup, Maryland, or approved substitute.
      a. Closely match color of existing cast stone. Cast stone is scheduled to be painted, therefore and exact color match is not necessary.

2.3 BRICK

A. Face Brick: ASTM C216, Grade SW, to match existing, each type, in size, color and texture.

B. Salvaged Face Brick: Using approved method, salvage undamaged brick from building where new door openings are scheduled and reuse for repairs.
C. Back-up Brick: Where brick is fully concealed provide common brick conforming to ASTM C62, Grade SW.

2.4 BRICK PATCHING MATERIAL

A. Description: Single-component, cementitious, mineral based mortar containing no synthetic polymers or additives designed for the restoration of brick. The mortar must be vapor permeable, frost and salt resistant, shrink resistant, and be physically compatible with the substrate, including, but not limited to porosity, tensile and compressive strength.

B. Product: Jahn M100 Brick Repair Mortar, as manufactured by Cathedral Stone Products Inc., Hanover, Maryland.

C. Stain for patching mortar (if necessary):
   1. General: Inorganic, breathable, color fast, mineral stain compatible with cementitious patching material specified.
      a. Silin Lasur Mineral Stain for Masonry, as manufactured by Cathedral Stone Products, Inc., Hanover, MD, (800) 684-0901.
      b. Epochrome S water-borne chemical toners for tinting unmatched mortar repairs, as manufactured by Cathedral Stone Products, Inc., Hanover, MD, (800) 684-0901.

2.5 MASONRY ACCESSORIES

A. Wall Ties: Corrugated stainless steel, 16 gauge by 1” wide, as manufactured by Hohmann & Barnard or approved substitute.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection
   1. Prior to work of this Section, carefully inspect the work of all other trades and verify that all such work is completed to the point where this installation may properly commence.
   2. Verify that masonry may be completed in accordance with all pertinent codes and regulations, the referenced standards, and the original design.
   3. Do not start work until mock-ups are accepted by the Architect.

B. 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.

3.2 CAST STONE PATCHING

A. Surface Preparation for Installation of Repair Mortar:
   1. Using methods approved via submittals, remove loose mortar, patches, and damaged unsound masonry to sound and solid substrate. Remove sealant residue.
   2. Anchors that are free of rust, solidly embedded, and do not project beyond the surface of the masonry unit may remain. All others should be removed.
   3. Cut the edges of the repair area to provide a minimum depth of ¼”. The edges of the repair should be square cut. Do not allow any feathered edged in the repair area.

B. Mixing, Application, and Curing of Repair Mortar:
   1. Mixing:
      a. General: Mix patching mortar in accordance with manufacturer’s printed instructions.
b. Do not mix more material than can be used within 30 minutes. Discard any material that has been mixed for 30 minutes or more.

c. Mixing ratios:
   1) Granite: Jahn M160; Approximately 5 parts dry material to 1 part water.
      a. Add water to dry ingredients and mix well. Adjust amount of water according to the weather and the porosity of the substrate.

2. Application:
   a. Apply the mortar mix using a trowel in a series of 1-inch lifts allowing mortar to dry approximately 10-20 minutes between lifts. If applied in layers, scrape off any cement skin that has formed and continue application. Dampen the surface before applying the next layer. Work mortar firmly into the surface of the masonry, including the corners, and under and around all mechanical anchors.
   b. Build up patching material so that it is slightly above adjacent masonry surface. Allow 15 to 30 minutes to set slightly (Wait time will vary with temperature and humidity—longer in cool weather), then scrape off excess material using a brush until the desired profile is reached. Do not press down or "float" the repair. Where patches occur at panel edges or corners, form mortar to match the profile of the surrounding masonry. In all cases, finish so that it is as indistinguishable as possible from the adjacent masonry.

3. Curing:
   a. Lightly mist patch with water to wet the entire surface of the finished patch approximately 30 minutes to 1 hour after completion on hot sunny days and approximately 2 hours or longer, on cool or cloudy days. Time will vary with temperature and humidity. Mist several times a day on the three days following the repair installation.

B. Finishing:
   1. Upon initial cure, and in accordance with the manufacturer’s printed instructions, patch shall be finished to match the existing adjacent masonry.
   2. Clean any mortar residue from area surrounding the patch by sponging as many times as necessary with clean water. This should be done before patching material sets.
   3. After the repair has been cured and allowed to dry for at least one week, if the appearance of a repair does not meet the specifications of the job, the surface color of the repair is to be enhanced by applying a vapor permeable, mineral-based pigmented stain.
      a. Remove dust and loose particulate matter from surfaces to receive coatings immediately prior to coating application.
      b. Protect all non-masonry surfaces such as glass, wood, metal, etc.
      c. Cracks and spalls must be repaired and cured prior to coating application.
      d. Apply specified coating to vertical surfaces only.
      e. Substrate must be completely dry before coating. Do not work when precipitation is expected within 48 hours of installation. The coating needs adequate time to bond to the substrate; Moisture disrupts the curing process.

C. Mixing Coating System:
   1. It is recommended that proper eye protection be worn during mixing in case of accidental splashing. Mix component A (colored paint) with component B (Silin AZ Fixative) in the desired proportions (see chart below) before installation.
   2. Mixing ratios will depend on the desired coating effect and the substrate surface.
      a. Transparent finish:
         (1) Parts of colored coating: 1
         (2) Parts of Silin AZ Fixative: 3-100+
      b. Refer to manufacturers data sheets for more detail on transparent finishes.

D. Adjustment and Cleaning:
1. Remove and replace all unsatisfactory patches, at no additional cost to the Owner. Conditions deemed unacceptable include, but are not limited to:
   a. Separation or shrinkage at the edge of a patch,
   b. Separation of the patch from the substrate,
   c. Surface crazing or cracking,
   d. “Burned” surfaces (from overly quick drying),
   e. Discoloration, or mis-matched color (compared to existing adjacent stone), and
   f. Mis-matched surface quality and finish (compared to existing adjacent stone).
2. Repair adjacent surfaces or other elements that have been marred or otherwise damaged during the work of this Section.
3. Remove uncured mortar from the perimeter of the repair before it dries using clean water and a rubber sponge. Repeat several times with clean water to prevent a halo effect. Cured mortar may only be removed chemically or mechanically.
   a. Should removal of cured mortar be necessary, Contractor shall submit proposed method of removal and obtain Architect’s approval prior to removal.
4. Once masonry patching work is complete, remove all unused materials, containers and equipment from the site, and dispose of all related debris.

3.5 BRICK REMOVAL AND REPLACEMENT

A. At locations indicated, remove bricks that are damaged, spalled, or deteriorated. Carefully demolish or remove entire units from joint to joint, without damaging surrounding masonry, in a manner that permits replacement with full-size units.
   1. When removing single bricks, remove material from center of brick and work toward outside edges.
B. Support and protect remaining masonry that surrounds removal area. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.
C. Notify Architect of unforeseen detrimental conditions including voids, cracks, bulges, and loose masonry units in existing masonry backup, rotted wood, rusted metal, and other deteriorated items.
D. Remove in an undamaged condition as many whole bricks as possible.
   1. Remove mortar, loose particles, and soil from brick by cleaning with hand chisels, brushes, and water.
   2. Store brick for reuse, as indicated.
      a. Document quantity of salvaged brick and submit to the Architect for determination of locations where salvaged brick will be reused.
      b. The goal is to use clean and undamaged salvaged units at localized repairs areas that are highly visible. Confirm locations with Architect prior to installation of salvaged brick.
E. Clean bricks surrounding removal area by removing mortar, dust, and loose particles in preparation for replacement.
F. Install replacement brick into bonding and coursing pattern of existing brick. If cutting is required, use a motor-driven saw designed to cut masonry with clean, sharp, unchipped edges.
G. Lay replacement brick with completely filled bed, head, and collar joints. Butter ends with sufficient mortar to fill head joints and shove into place. Wet both replacement and surrounding bricks. Use wetting methods that ensure that units are nearly saturated but surface is dry when laid. Maintain joint width for replacement units to match existing joints.
   1. Tool exposed mortar joints in repaired areas to match joints of surrounding existing brickwork.
2. Rake out mortar used for laying brick before mortar sets and point new mortar joints in repaired area to comply with requirements for repointing existing masonry, and at same time as repointing of surrounding area.

3.6 BRICK PATCHING (For holes less than 1 ½” in diameter)

A. Remove loose material from brick surface. Remove additional material so patch will not have feathered edges and will be at least ¼-inch thick, but not less than recommended by patching compound manufacturer.

B. Mask or remove surrounding mortar joints if patch will extend to edge of brick.

C. Mix patching compound in individual batches to match each unit being patched. Combine one or more colors of patching compounded, as needed, to produce exact match.

D. Rinse surface to be patched and leave damp, but without standing water.

E. Brush-coat surfaces with slurry coat of patching compound according to manufacturer’s written instructions.

F. Place patching compound in layers as recommended by patching compound manufacturer, but no less than ¼-inch thick or more than 2-inches thick. Roughen surface of each layer to provide a key for next layer.

G. Trowel, scrape, or carve surface of patch to match texture and surface plane of surrounding brick. Shape and finish surface before or after curing, as determined by testing, to best match existing brick.

H. Keep each layer damp for 72 hours or until patching compound has set.

3.7 ROUTING AND REPOINTING MORTAR JOINTS

A. Rake out and repoint mortar joints to the following extent:
   1. All joints in areas indicated.
   2. Joints where mortar is missing or where they contain holes.
   3. Cracked joints, where mortar has separated from unit masonry.
   4. Brick joints where they are worn back ¼-inch or more from surface of unit masonry.
   5. Joints where they sound hollow when tapped by metal object.
   6. Stone joints where beaded profile is damaged.
   7. Joints where they are deteriorated to point that mortar can be easily removed by hand.
   8. Joints, other than those indicated as sealant-filled joints, where they have been filled with substances other than mortar

B. Do not rake out and repoint joints where not required.

C. Rake out joints as follows:
   1. Remove mortar from joints to depth equal to 2-1/2 times joint width, but not less than 1/2 inch or depth at which sound mortar is reached.
   2. Remove mortar from masonry surfaces within raked-out joints to provide reveals with square backs and to exposed masonry for contact with pointing mortar. Brush, vacuum, or flush joints to remove dirt and loose debris.
   3. Do not spall edges of masonry units or widen joints. Replace or patch damaged masonry units as directed by Architect.
      a. Cut out mortar by hand with chisel and mallet. Do not use power-operated grinders without Architect’s written approval based on submission by Contractor of a satisfactory
quality-control program and demonstrated ability of operators to use tools without damaging masonry units. Quality-control program shall include provisions for supervising performance and preventing damage due to worker fatigue.

b. Cut out center of mortar joints using angle grinders with diamond-impregnated metal blades. Remove remaining mortar by hand with chisel and mallet. Strictly adhere to written quality-control program. Quality-control program shall include provisions for demonstrating ability of operators to use tools without damaging masonry, supervising performance, and preventing damage due to worker fatigue.

D. Notify Architect of unforeseen detrimental conditions including voids in mortar joints, cracks, loose masonry units, rotted wood, rusted metal, and other deteriorated items.

E. Allow for three mortar colors. One mortar color will be used at terra cotta materials, the second color on brick masonry, and the third color on granite material.

F. Point joints as follows:
   1. Rinse masonry-joint surfaces with water to remove dust and mortar particles. Time rinsing application so, at time of pointing, joint surfaces are damp but free of standing water. If rinse water dries, dampen masonry-joint surfaces before pointing.
   2. Apply pointing mortar first to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than 3/8 inch until a uniform depth is formed. Fully compact layer thoroughly and allow it to become thumbprint hard before applying next layer.
   3. After low areas have been filled to same depth as remaining joints, point all joints by placing mortar in layers not greater than 3/8 inch. Fully compact each layer and allow to become thumbprint hard before applying next layer. Where existing masonry has worn or rounded edges, slightly recess finished mortar surface below face of masonry to avoid widened joint faces. Take care not to spread mortar over edges onto exposed masonry surfaces or to featheredge mortar.
   4. When mortar is thumbprint hard, tool joints to match original appearance of joints. Remove excess mortar from edge of joint by brushing.
      a. Original stone mortar joints below 1st floor sill course: Beaded profile tooled to match original.
      b. Existing brick mortar joints: Concave profile.
      c. Below grade masonry or masonry not exposed to view: Flush joint.

G. Cure mortar by maintaining in thoroughly damp condition for at least 72 hours, including weekends and holidays.
   1. Acceptable curing methods include covering with wet burlap and plastic sheeting, periodic hand misting, and periodic mist spraying using system of pipes, mist heads, and timers.
   2. Adjust curing methods to ensure that pointing mortar is damp throughout its depth without eroding surface mortar.
   3. Where repointing work precedes cleaning of existing masonry, allow mortar to harden at least 30 days before beginning cleaning work.

3.8 ADJUST AND CLEAN

A. After mortar has hardened but before it has fully cured, thoroughly clean masonry surfaces of excess mortar using stiff nylon or natural bristle brushes and clean water; do not use metal brushes or scrapers.

B. Any masonry work that does not result in a consistent appearance with adjacent brickwork and stonework shall be considered defective and shall be corrected by the Contractor at no additional cost to the Owner.
3.9 FIELD QUALITY CONTROL

A. Architect’s Project Representatives: Architect will assign Project representatives to help carry out Architect’s responsibilities at the site, including observing progress and quality of portion of the Work completed. Allow Architect’s Project representatives use of scaffolding, as needed, to observe progress and quality of portion of the Work completed.

B. Notify Architect’s Project representatives two weeks in advance of times when lift devices and scaffolding are scheduled to be relocated. Do not relocate lift devices and scaffolding until Architect’s Project representatives have had reasonable opportunity to make inspections and observations of work areas at lift device or scaffold location and only when the completed work is accepted in writing by the Architect.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Mortar materials.
   2. Mortar mixes.

B. Related Sections:
   1. Division 1: Administrative, procedural, and temporary work requirements.
   2. Section 04 01 20 - Masonry Restoration.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM)
   1. C 144 - Aggregate for Masonry Mortar.
   5. C 1324 - Examination and Analysis of Hardened Masonry Mortar.

1.3 SUBMITTALS

A. Samples:
   1. Submit two cured mortar samples of mortar color required, 6 x 1/2 x 1/2 inches in size.
   2. Samples will be compared to original unweathered samples to determine acceptability of match.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect materials from moisture absorption and damage; reject damaged containers.

B. Store sand to prevent inclusion of foreign matter.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Portland Cement:
   1. Type: ASTM C 150, Type II, containing maximum 0.60 percent alkali (sodium oxide) and maximum 0.15 percent water soluble alkali by weight.
   2. Color: To match original mortar.

B. Lime: ASTM C 207, Type S, hydrated masonry type.

C. Sand: ASTM C 144; color, size, and type to match original mortar.

D. Water: Potable, clean, and free of oils, acids, alkalis, salts and organic matter.
E. Other Components: As determined by original mortar analysis to produce visual and performance characteristics to match original mortar.

F. Air Entraining, Antifreeze, Bonding, and Other Additives: Not permitted.

2.2 MIXES

A. Proportions: Type N mortar, 1 part Portland cement, 1 part lime, and 6 parts sand.

B. Ultimate Compressive Strength: Not to exceed that of original mortar or masonry.

2.3 MIXING MORTAR

A. Thoroughly mix ingredients in quantities needed for immediate use.

B. Mix dry ingredients mechanically until uniformly distributed; add water to achieve workable consistency.

C. Discard lumpy, caked, frozen, and hardened mixes, and mixes not used within 2 hours after initial mixing.

D. Use mortar within 2-1/2 hours after initial mixing at ambient temperatures below 80 degrees F and within 1-1/2 hours after initial mixing at ambient temperatures over 80 degrees F.

E. Do not add antifreeze compounds to lower freezing temperature of mortar.

F. Provide consistent color for exposed mortar.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install mortar per Section 04 01 20 – Masonry Restoration.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Replace existing railing at east parking lot steps with code compliant railing.
   2. Provide ADA compliant railings at south ramps adjacent to handicap parking spaces.
   3. Replace existing railings with ADA compliant railings at north ramp adjacent to handicap parking spaces.
   4. Miscellaneous accessories and fasteners.
   5. Galvanizing and shop priming of exterior ferrous metal assemblies/components.

B. Related Sections:
   1. Division 1: Administrative, procedural, and temporary work requirements.
   2. Section 32 16 23 – Portland Cement Concrete Paving.
   3. Section 09 91 00 – Painting and Finishing for finish painting of fabricated metal elements.

1.2 REFERENCES


B. ASTM International (ASTM):
   1. A 36/A 36M - Carbon Structural Steel.
   3. A 108 - Steel Bars, Carbon, Cold-Finished, Standard Quality.
   5. A 123/A 123M - Zinc (Hot-Galvanized) Coatings on Iron and Steel Products.
  10. A 320 – Alloy Steel Bolting Material for Low Temperature Service.
  12. A 500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
  13. A 501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
  15. A 569/A569M - Commercial Steel (CS) Sheet and Strip, Carbon (0.15 Maximum Percent), Hot-Rolled.
  17. E 985 - Permanent Metal Railing Systems and Rails for Buildings.

C. NAAMM, Metal Finishes Manual.

D. Society for Protective Coatings (SSPC) - Painting Manual.
1.3 QUALITY ASSURANCE

A. Field Measurements:
   1. Take field measurements where required prior to preparation of Shop Drawings and fabrication to ensure proper fitting of the Work.

B. Shop Assembly:
   1. Preassemble items in the shop to the greatest extent possible, so as to minimize field splicing and assembly of units at the project site. Disassemble units only to the extent necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

1.4 SUBMITTALS

A. Product Data: Submit for all products proposed for use, include manufactured components; indicate dimensions, profiles, materials, finishes, and attachments.

B. Shop Drawings: Shop drawings for the fabrication and erection of all assemblies of miscellaneous metal work, which are not completely shown by manufacturer's data sheets. Include plans and elevations at not less than 1” to 1'-0" scale, and include details of sections and connections at not less than 3" to 1-0" scale. Show dimensions, metal thicknesses, finishes, joints, attachments, anchorage, and accessory items. Show relationship of work to adjacent construction.
   1. Field Measurements: Check actual locations of wall and other construction to which metal fabrications must fit by accurate field measurements before fabrication. Show recorded measurements on shop drawings.

C. Mock-ups:
   1. Provide mock-ups of the following items illustrating materials, components, profiles, assembly, attachment, and finish proposed for final work.
      a. Metal railing at east parking lot steps, construct min. 5-foot long section by full height.
   2. Locate where directed.
   3. Approved mock-ups, if undamaged at the time of Substantial Completion, may remain as part of the work.

1.5 PERFORMANCE REQUIREMENTS

A. Design Requirements: Minimum design loads:
   1. Handrails, railings, and guardrails:
      a. Concentrated lateral force of 250 pounds at any point.
      b. Uniform load of 50 pounds per linear foot applied in any direction.
      c. Maximum deflection under loading: L/120.
      d. Concentrated and uniform loads do not need to be applied simultaneously.
      e. Fabricate handrails and railings in accordance with ASTM E 985.

PART 2- PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
2.2 FERROUS METALS

A. Steel:
   1. Shapes: ASTM A 36/A 36M.

2.3 FASTENERS:

A. Fasteners for Anchoring Handrails and Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring handrails and railings to other types of construction indicated and capable of withstanding design loads.
   1. For steel handrails, railings, and fittings, use plated fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.

2.4 ACCESSORIES

A. Paint:
   1. Shop Primers: provide primers complying with applicable requirements in Section 09 91 00 – Painting and Finishing.
   2. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664; selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

B. Anchoring Cement:
   1. Description: Factory-packaged, non-staining, hydraulic controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without need for protection by a sealer or waterproof coating and is recommended for exterior use by manufacturer.

2.5 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

D. Exposed Mechanical Fastenings: Flush countersunk screws or bolts, unobtrusively located, consistent with design of component except where specifically noted otherwise.

E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

F. Conceal fastenings where possible.

G. Welding to conform to AWS D1.1.
   1. Use welds for permanent connections where possible. Grind exposed welds smooth.
2. Tack welds prohibited on exposed surfaces.

2.6 FINISHES GENERAL

A. Comply with NAAMM’s "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.7 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize exterior items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
   1. Shop prime with universal shop primer unless zinc-rich primer is indicated.

C. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, “Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel,” for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install items in accordance with approved Shop Drawings.

B. Install components plumb, level, and rigid.

C. Welding: AWS D1.1. Grind and fill exposed welds; finish smooth and flush.

D. Install sleeved components with anchoring cement.

3.2 ADJUSTING

A. Clean and touch up primer paint at welded and abraded surfaces with same product as applied in shop.

B. Clean and touch up galvanized coatings at welded and abraded surfaces in accordance with ASTM A 780, Annex A2.

3.3 SCHEDULE

A. This Schedule includes principal items only; refer to Drawings for items not specifically listed.

B. Exterior:
   1. Railings at site steps and ramps where indicated on the Drawings
      a. Fabricate from stock steel components of sizes indicated.
      b. Posts and Horizontal Members: 1 1/2” diameter tubes.
c. Finish: Galvanized, primed and finish painted.

END OF SECTION
PART I - GENERAL

1.1 SECTION INCLUDES

A. All materials and labor for work requiring new lumber for:
   1. Wood blocking and furring not exposed to view, including blocking as required for proper installation of items provided by the owner including but not limited to the following: Projector screen, projector, T.V., white board, furnishings, etc.
   2. Wood blocking and furring not exposed to view.
   3. Electrical, IT, and Security panel backboards.
   4. Connecting hardware, fasteners, and accessories

B. RELATED SECTIONS
   1. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
   2. Section 06 41 00 – Custom Cabinets.
   3. Section 07 54 23 – TPO Roofing.
   4. Section 07 62 00 – Sheet Metal Flashing and Trim.
   5. Section 08 41 27 – Aluminum Frame Entrances and Storefronts.
   6. Section 10 28 00 – Toilet and Bath Accessories.
   7. Section 10 44 16 – Fire Extinguisher.

1.2 QUALITY ASSURANCE

A. All dimension lumber and engineered wood products shall bear a legible grade stamp of a certified lumber grading agency.

B. Each piece or bundle of treated wood products shall bear a legible third-party quality mark or tag indicating the name of the treater, date of treatment or lot number and the American Wood Preservers’ Association (AWPA) Specification symbol to which the treatment conforms.

C. Provide Underwriters’ Laboratories (UL) approved identification for fire resistant treated materials.

D. Unless noted otherwise, all rough carpentry work shall conform to the conventional framing rules of the applicable building code.

1.3 SUBMITTALS

A. Submit shop drawings and product data, describe materials, fasteners, fastening methods, accessories, and locations.

B. Submit documentation of wood treatment facility’s qualifications and compliance with American Wood Preserver’s Association (AWPA) standards.

1.4 STORAGE AND HANDLING

A. All wood products shall be placed on blocking so that the material does not sag and is completely out of ground-contact.

B. All wood products shall be protected from rain and direct sunlight.
C. Materials shall be stored on site no more than 30 days prior to use. Once un-bundled, materials must be installed immediately unless stickered and protected in a manner approved by the Architect.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Dimension lumber (2 inches-4 inches thick): No. 2 Grade Southern Pine, visually graded according to the published grading rules of the Southern Pine Inspection Bureau. Unless otherwise noted, dimension lumber shall be kiln dried to 15 percent moisture content, surfaced S4S.

B. Blocking shall be No. 2 Grade Southern Pine, nominal thickness, unless otherwise noted.

C. Shims shall be taper-sawn western red cedar or approved substitute.

2.2 PLYWOOD PANELS

A. Construction Panel Standards: Comply with PS 1 “U.S. Product Standard for Construction and Industrial Plywood” for plywood construction panels and for products not manufactured under PS 1 provisions with APA PRP-108.

B. Plywood Backing Panels: For mounting electrical or telephone equipment, provide plywood panels with grade designation, APA C-D PLUGGED EXPOSURE 1, not less than ¾-inch.

2.3 PRESERVATIVE TREATMENT

A. Preservative Treatment: Comply with applicable requirements of AWPA C2 (Lumber) and AWPA C9 (plywood). Provide treatment after members are shaped with waterborne chromated copper arsenate (CCA) preservative by vacuum pressure full-cell process in accordance with AWPA Standard Specification P-5 and as follows:

1. Above Ground Use Waterborne CCA Dry Salt Retention: 0.25 lb./cu. ft.
2. Ground Contact Use Waterborne CCA Dry Salt Retention: 0.40 lb./cu. ft.
3. In Ground Use Waterborne CCA Dry Salt Retention: 0.60 lb./cu. ft.
4. Above Ground Use Oil Borne Penta Preservative Retention: 0.40 lb./cu. ft.
5. Kiln dry members after treatment to 15% MC. Mark each treated item with the Quality Mark Requirements of an inspection agency approved by ALSC's Board of Review.
   a. Re-grade and re-stamp lumber after kiln drying in accordance with lumber producer's grading rules.
   b. Apply preservative field treatment to cut and bored surfaces in accordance with AWPA M4.

2.4 FIRE RETARDANT TREATMENT

A. Comply with AWPA Standards C20 (Lumber) and C27 (Plywood). Provide materials with a flame spread not exceeding 25 (ASTM E 84). Identify “fire retardant treated wood” with appropriate UL classification marking or other testing and inspection agency marking acceptable to authorities having jurisdiction. Provide materials as follows:

1. Exterior Exposure Treatment Process: Hickson Corporation "NCX" or Hoover Treated Wood Products "Exterior Fire-X".
2. Interior Exposure Treatment Process: Hickson Corporation "Dricon", Osmose "Flameproof LHC-HTT".
3. Kiln dry after treatment to maximum moisture content of 15% for plywood, 19% for lumber.
4. Do not use twisted, warped, bowed or otherwise defective wood.
2.5 FASTENERS, ADHESIVES & ACCESSORY MATERIALS

A. All fasteners in exterior or treated wood shall be stainless steel, or shall have an approved corrosion resistant coating.

B. Nails: common wire nails of the size shown on the plans.

C. Bolts: ASTM A 307, Grade A, unless otherwise noted.

D. Concrete or masonry substrate: galvanized anchor with expansion shank, or threaded concrete screw anchor, length as shown on the plans or as recommended by manufacturer for minimum 1,000 pound pull-out resistance. Approved manufacturers:
   1. Tapcon
   2. Hilti
   3. Rawl

E. Connector hardware: approved manufacturers:
   1. Cleveland Steel Specialty Co. (Cleveland, Teco)
   2. United Steel Products Co. (Kant-Sag - Silver)
   Simpson Strong-Tie

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify all dimensions and existing conditions in the field.

B. Verify that surfaces are ready to receive work.

C. Verify mechanical, electrical, and building items affecting work of this Section are ready to receive this work. Notify the engineer of any such items requiring adjustment.

D. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

A. Remove existing materials to be replaced.

B. Accurately measure or scribe members before cutting. Make all cuts clean and true to mating surfaces. All lumber and timber shall be accurately cut and framed to a close fit so that the joints will have even bearing over the entire contact surface.

C. Treat all field-cuts of existing and new treated material with an approved water repellent preservative.

D. Firestop concealed spaces of wood framed walls, furring, and partitions at each floor level and at the ceiling line of the top story. Use closely-fitted wood blocks of nominal 2" thick lumber of the same width as framing members.

E. Set and secure materials and components in place, plumb, and level.

F. Discard units of material with defects, which might impair quality of work, and units that are too small to use in fabricating work with minimum joints or optimum joint arrangement.

G. Set carpentry work accurately to required levels and lines, with members plumb and true and accurately cut and fitted.
H. Securely attach carpentry work to substrate by anchoring and fastening as shown and as required by recognized standards. Countersink nail heads on exposed carpentry work and fill holes.

I. Bridging and blocking shall be provided where shown on the plans or as required to prevent warping or twisting of installed materials. Bridging and blocking shall be framed neatly and accurately, and securely toenailed with at least two nails in each end.

J. Connecting hardware shall be installed in accordance with the manufacturer’s recommendations.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Custom base and upper cabinets and counters in Offices, Conference Rooms, and Breakrooms and other areas where shown on the Drawings.
   2. Accessories including desk grommets and wire management systems, drawer slides, standards, and hardware for custom cabinets and counters.
   3. Shop finishing.

B. Related Sections:
   1. Division 1: Administrative, procedural, and temporary work requirements.
   2. Section 06 10 00 – Rough Carpentry for furring, blocking, and other carpentry work not exposed to view.
   3. Section 07 92 00 - Joint Sealers.
   4. Section 12 36 61 – Quartz Countertops for Break Rooms.

1.2 REFERENCES

A. Architectural Woodwork Institute (AWI) - Architectural Woodwork Quality Standards.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Include dimensioned plan, sections, elevations, and details, including interface with adjacent work.
   2. Show details at scale not less than 3 inches = 1 foot.
   3. Designate wood species and finishes.

B. Samples:
   1. 6”x6” samples of panel product with HPDL veneer, three samples of each veneer specified.
   2. Finish hardware, one of each type specified.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with Grades indicated:
   1. Architectural Cabinets AWI Section 400: Custom Grade quality.

B. Work in this Section shall comply with the specified Grade of Work and Sections of current edition of the AWI/AWMAC Quality Standards Illustrated.

1.5 QUALIFICATIONS

A. Contractors and their personnel engaged in the work shall be able to demonstrate successful experience with work of comparable extent, complexity and quality to that shown and specified.
B. Manufacturers who are members in good standing of the Architectural Woodworking Institute (AWI) or the Architectural Woodwork Manufacturers Association of Canada (AWMAC) and are familiar with this Standard.

1.6 DELIVERY, STORAGE AND HANDLING

A. Do not deliver materials until proper protection can be provided, and until needed for installation.

1.7 PROJECT CONDITIONS

A. Environmental Requirements: HVAC system complete and operational for minimum 7 days prior to installation of casework.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Panel Products:
   1. Graded in accordance with AWI Section 200 requirements for quality grade specified.
   2. Exposed and semi-exposed veneers:
      a. Quality: Custom Grade.
         (1) Upper and Base Cabinets: Woodgrain, TBD with fine velvet finish, as manufactured by TBD.
         (2) Counter tops: TBD.
   3. Panel core: Particleboard, medium density fiberboard, or combination type.

2.2 ACCESSORIES

A. Grommets for cable passage through countertops: 1 1/4 –inch O.D., color to closely match countertop, molded-plastic grommets and matching plastic caps with slot for wire passage.

B. Fasteners: Type and size as required by conditions of use.

C. Finish Hardware: As scheduled at end of Section, or approved substitute.

D. Joint Sealers: Specified in Section 07 92 00.

2.3 FABRICATION

A. Prior to fabrication, field verify dimensions to ensure correct fit.

B. Shop prepare and identify components of assemblies for matching during site assembly.

C. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

D. Cabinet style: Flush overlay.

E. Underside wall cabinet finish style commensurate with the cabinet style specified above.

F. Provide cutouts and reinforcement for plumbing, electrical, and accessories. Prime paint surfaces of cut edges.
PART 3 - EXECUTION

3.1 PREPARATION

A. Prior to installation, condition casework to average humidity that will prevail after installation.

3.2 INSTALLATION

A. Install in accordance with AWI Section 1700:
   1. Custom Grade.

B. Set casework plumb, rigid and level.

C. Scribe to adjacent construction with maximum 1/8 inch gaps.

3.3 FINISH HARDWARE SCHEDULE

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>MANUFACTURER</th>
<th>MODEL</th>
<th>FINISH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjustable shelf standards and brackets</td>
<td>Knape and Vogt</td>
<td>233/255 pilaster standards &amp; supports</td>
<td>Nickel</td>
</tr>
<tr>
<td>Drawer slide</td>
<td>Accuride</td>
<td>3832EC</td>
<td>Nickel</td>
</tr>
<tr>
<td>Door hinges</td>
<td>Blum</td>
<td>Clip hinge series</td>
<td>Nickel</td>
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<tr>
<td>Door pull</td>
<td>HAFELE</td>
<td>100.45.051</td>
<td>Matte Stainless</td>
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<tr>
<td>Drawer pull</td>
<td>HAFELE</td>
<td>134.81.617</td>
<td>Matte Stainless</td>
</tr>
</tbody>
</table>

END OF SECTION
SECTION 07 21 00
BUILDING INSULATION

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 the following:
   1. Acoustical batt insulation for interior partitions as indicated on partition types.
   2. Acoustical batt insulation at ceilings where gyp board partitions do not extend to the underside of the structure.

B. Related Sections include the following:
   1. Section 09 29 00 – Gypsum Board Assemblies for interior partitions and suspended ceiling.
   2. Section 09 51 13 – Acoustic Panel Ceilings for suspended acoustic ceilings.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for insulation products.

C. Research/Evaluation Reports: For foam-plastic insulation.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Glass-Fiber (Acoustic Batt) Insulation:
   a. CertainTeed Corporation.
   c. Knauf Fiber Glass.
   d. Owens Corning.

2.2 INSULATING MATERIALS

A. General: Provide insulating materials that comply with requirements and with referenced standards.

1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.

B. Interior Partition Walls and Above Ceilings
   1. Provide sound attenuation batt insulation complying with ASTM C665, Type I.
   2. Size: 3 ½ inch thickness, 16 inch width for installation in metal framing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the areas and conditions where building insulation is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's instructions for the particular conditions of installation in each case. If printed instructions are not available or do not apply to the project conditions, consult the manufacturer's technical representative for specific recommendations before proceeding with the work.

B. Extend insulation full thickness as shown over entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections, which interfere with placement.

C. Apply a single layer of insulation to the required thickness, unless a double layer is required, to make up the total thickness shown.
D. Place insulation away from recessed light fixtures that are not designed for direct insulation contact.

3.3 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION
SECTION 07 54 23
TPO MEMBRANE ROOFING

PART - GENERAL

1.1 SUMMARY

A. The existing TPO roofing system is approximately 6-7 years old and currently has 8-9 years remaining on a 15 year manufacturer’s warranty. The contractor is responsible for fully protecting the existing roofing in areas of work for the duration of the project, modifying the roofing as required to complete the work of this contract and completing the work as recommended by the roofing manufacturer as needed to retain the warranty. The County shall have the manufacturer’s technical representative inspect the TPO roofing at the end of the project and provide a report indicating any deficiencies. The contractor shall be responsible for repairing the roofing as directed by the technical representative at no additional cost to the County.

1. Provide walk-way pads from a designated point of access at grade where a ladder will access the roof to roof top equipment for maintenance. Roof plan shows proposed route.

B. Related Sections:

1. Section 06100 - Rough Carpentry for nailers, blocking, and plywood backing.
2. Section 07620 - Sheet Metal Flashing and Trim.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

3. D 312 - Asphalt Used in Roofing.
4. D 2178 - Asphalt Glass Felt Used in Roofing and Waterproofing.
17. FM 1-29 - Roof Deck Securement and Above Deck Roof Components; Factory Mutual System; 2005.

B. National Roofing Contractors Association (NRCA) - Roofing and Waterproofing Manual.


1.3 PERFORMANCE REQUIREMENTS

A. Install a watertight, TPO Thermoplastic Polyolefin membrane roofing and base flashing system with compatible component that will not permit the passage of liquid water and will withstand wind loads, thermally induced movement, and exposure to weather without failure.

B. Roofing System Design: Provide a roofing system that complies with roofing system manufacturer’s written design instructions for warranty period indicated.

1.4 SUBMITTALS

A. Product Data: Manufacturer’s product specifications, installation instructions, and general recommendations for each principal roofing system product required.

1. Installation Instructions: Provide manufacturer’s instructions to installer, marked up to show exactly how all components will be installed; where instructions allow installation options, clearly indicate which option will be used.

B. Samples: Submit samples of each product to be used. Provide samples of materials with approval by manufacturer of all materials not supplied by roofing manufacturer.

C. Shop Drawings: For each detail that will affect the existing roofing with references to manufacturer’s standard details. Details which do not conform to roofing manufacturer’s standard shall be identified with separate approval from roofing manufacturer. Details to be employed on the project shall be approved by roofing manufacturer.

D. Letter from the proposed primary roofing manufacturer stating that the proposed application will comply with the manufacturer’s requirements in order to maintain the existing warranty.

E. Inspection Report: Copy of roofing system manufacturer’s inspection report of completed roof installation.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications:

1. Minimum 3 years documented experience applying specified roofing system.
2. Approved by primary roofing materials manufacturer, provide letter from manufacturer attesting that the roofing installer meets the specified qualifications.

B. Roofing System: (UL) Class A Fire Hazard Classification, tested to ASTM E 108.

C. Pre-Installation Conference:

1. Convene two weeks prior to commencing work of this Section.
2. Attendance: Architect, Owner, Construction Manager, roofing applicator, roofing manufacturer’s representative, and related trades that may affect roofing installation prior to, during or following application.
3. Review and discuss: Contract Documents, roofing system manufacturer's literature, job conditions, scheduling, and other matters affecting application as appropriate.

4. If possible, tour representative areas of roofing substrates; discuss substrate construction, related items, work conditions, and materials compatibility.

1.6 DELIVERY, STORAGE AND HANDLING

A. Handle rolled goods to prevent damage to ends.

B. Protect materials against moisture absorption, direct sunlight, damage, and temperatures above 110 degrees F and below 40 degrees F.

C. Store materials off ground or roof deck on pallets. Cover materials stored outside with breathable covering.

D. Deliver products in manufacturer's original containers, dry and undamaged, with seals and labels intact and legible.

E. Keep combustible materials away from ignition sources.

1.7 PROJECT CONDITIONS

A. Environmental Requirements:
   1. Do not apply to damp, wet or frozen substrate or during precipitation.
   2. Do not apply emulsions when temperature is below 40 degrees F, or if freezing weather is anticipated within 24 hours after application. Do not use frozen materials.
   3. Proceed with roofing work only when existing and forecasted weather conditions permit roofing to be installed according to manufacturer's written instructions and warranty requirements.

B. SEQUENCING
   1. Do not install more insulation than can be protected with roofing during the same day.
   2. Staging of roof membrane application or temporary membrane is not acceptable; install system in final form each day. If phased roofing occurs as result of emergency conditions, install additional plies over phased areas.
   3. Install water stops at exposed edges of roofing system if work is stopped due to adverse weather conditions.
   4. Complete flashings daily.

1.8 WARRANTY

A. A manufacturer's representative shall inspect the installation for compliance with manufacturer's standards upon completion of the roofing system.

B. Maintain manufacturer's 15-year warranty against water leakage through roofing system, unlimited as to dollar amount.

PART 2 – PRODUCTS

2.1 MANUFACTURERS:

A. Acceptable Manufacturers:

B. Substitutions: No substitutions.
2.2 TPO MEMBRANE MATERIALS
   A. Provide materials to match the existing TPO roofing system and recommended by the initial roofing installer and manufacturer. Contact the following parties for detailed description of the existing roofing system:
   B. TPO roofing installer: Confirm with Milam County
   C. TPO roofing manufacturer: Confirm with original roofing installer.

2.3 TEMPORARY ROOF PROTECTION
   A. Minimum 3/8” thick plywood on minimum 1” thick layer of polyisocyanurate insulation. Joints should be taped and entire assembly ballasted with sandbags. Provide double 2x8 block where scaffolding legs will rest on the roof.

2.4 WALKWAY PADS
   A. Description: 150 Mil thick, textured non-reinforced TPO fully adhered to TPO cap sheet.
   B. Product: JM TPO Walkpad as manufactured by Johns Manville, or approved equal by existing roof membrane manufacturer. Confirm compatibility of proposed walkway pads with existing cap sheet to remain.

PART 3 – EXECUTION

3.1 GENERAL
   A. Install roofing, insulation, flashings, and accessories in accordance with roofing manufacturer’s published instructions and recommendations for the specified roofing system. Where manufacturer provides no instructions or recommendations, follow good roofing practices and industry standards. Comply with federal, state, and local regulations.
   B. Obtain all relevant instructions and maintain copies at project site for duration of installation period
   C. Temporary closures, which ensure that moisture does not damage any completed section of the new roofing system, are the responsibility of the applicator. Completion of flashings, terminations, and temporary closures shall be completed as required to provide a watertight condition.

3.2 PROTECTION OF OTHER WORK
   A. Protect adjacent construction, property, vehicles, and persons from damage related to roofing work; repair or restore damage caused by roofing work
      1. Protect from spills and overspray from bitumen, adhesives, sealants and coatings.
      2. Particularly protect metal, glass, plastic, and painted surfaces from bitumen, adhesives, and sealants within the range of wind-borne overspray.
      3. Protect finished areas of the roofing system from roofing related work traffic and traffic by other trades.

3.3 EXAMINATION
   A. Verify that surfaces and site conditions are ready to receive work.
B. Examine roof deck to determine that it is sufficiently rigid to support roofers and their equipment and that deflection will not strain or rupture roof components or deform deck.

C. Verify deck is clean and smooth, free of depressions, waves, or projections. Examine substrate to determine that surface is in a suitable condition for roofing work. Do not start roof application until defects have been corrected.

D. Verify roof openings, curbs, pipes, sleeves, ducts, and bents through roof are solidly set and cant strips, wood nailing strips are in place.

3.3 WOOD NAILER LOCATION AND INSTALLATION

A. Total wood nailer height shall match the total thickness of insulation being used and shall be installed with a 1/8” gap between each length and at each change of direction.

B. Wood nailers shall be firmly fastened to the deck. Mechanically fasten wood nailers to resist a force of 200 lbs per lineal foot.

3.4 INSULATION AND COVER BOARD INSTALLATION

A. Install only as much insulation as can be covered with the completed roofing system before the end of the day’s work or before the onset of inclement weather.

B. Seal deck joints, where needed, to prevent bitumen drips and leaks into building.

C. Lay roof insulation in courses parallel to roof edges.

D. Neatly fit insulation to all penetrations, projections, and nailers. Insulation shall be fit tightly, with gaps not greater than 1/4”. All gaps greater than 1/4” shall be filled with acceptable insulation. Under no circumstances shall the roofing membrane be left unsupported over a space greater than 1/4”.

E. When installing multiple layers of insulation, all joints between layers shall be staggered at least 6 in.

F. Cold Adhesive Attachment: Apply in accordance with membrane manufacturer’s instructions and recommendations; “walk-in” individual roof insulation boards to obtain maximum adhesive contact. Clean concrete roof deck and prime with specified primer prior to application of insulation adhesive.

3.5 MEMBRANE INSTALLATION

A. Beginning at low point of roof, place membrane without stretching over substrate and allow to relax at least 30 minutes before attachment or splicing; in colder weather allow for longer relax time.

B. Lay out the membrane pieces so that field and flashing splices are installed to shed water.

C. Install membrane without wrinkles and without gaps or fishmouths in seams; bond and test seams and laps in accordance with membrane manufacturer’s instructions and details.

D. Install membrane adhered to the substrate, with edge securement as specified.

E. Adhered Membrane: Bond membrane sheet to substrate using membrane manufacturer’s recommended bonding adhesive, application rate, and procedures.

F. Edge Securement: Secure membrane at all locations where membrane terminates or goes through an angle change greater than 2 in 12 inches using mechanically fastened reinforced perimeter fastening strips, plates, or metal edging as indicated or as recommended by roofing manufacturer.

1. Exceptions: Round pipe penetrations less than 18 inches in diameter and square penetrations less than 4 inches square.
3.6 FLASHING AND ACCESSORIES INSTALLATION

A. Perimeters, curbs, vents, expansion joints, drains, and other details shall be flashed.
   1. Install flashings, including laps, splices, joints, bonding, adhesion, and attachment, as required
      by membrane manufacturer's current recommendations and details.

3.7 WALKWAY INSTALLATION

A. Membrane shall be clean and dry. Remove any visible dirt and debris.

B. Position walkway roll and cut to desired length.

C. Walkway shall not cover seams. Walkway roll shall be kept a minimum of 2 inches from the edge of
   the seam on the bottom sheet of the completed lap and a minimum of 6 inches from the edge of the
   seam when located on the top sheet of a completed lap.

D. Weld perimeter of walkway roll to the membrane following standard welding procedures. Spaced 2
   inches long "weep" breaks in the weld seam are required on the low slope edge of the pad to prevent
   the accumulation of water under the pad.

3.8 FIELD QUALITY CONTROL

A. Inspection by Manufacturer: Provide final inspection of the roofing system by a Technical
   Representative employed by roofing system manufacturer specifically to inspect installation for
   warranty purposes (i.e. not a sales person).

B. Correct identified defects or irregularities, in addition to those required by the manufacturer for
   issuance of warranty.

3.9 CLEAN-UP

A. Clean all contaminants generated by roofing work from building and surrounding areas, including
   bitumen, adhesives, sealants, and coatings.

B. In areas where finished surfaces are soiled by work of this Section, consult manufacturer of surfaces
   for cleaning advice and conform to their instructions.

C. Remove excess materials, trash, debris, equipment, and parts from the Work.

D. Repair or replace defaced or disfigured finishes caused by work of this Section.

END OF SECTION
SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Flashings and sheet metal associated with repairs to existing membrane roofing systems, including custom fabricated sheet metal covers over existing curbs at removed MEP equipment and distribution systems.
2. Counterflashings and base flashings at canopies.
3. Flashing not exposed to view at window and door openings.
4. Flashing not exposed to view within exterior wall assemblies.

B. Related Sections:

1. Division 1: Administrative, procedural, and temporary work requirements.
2. Section 06 10 00 – Rough Carpentry.
3. Section 07 27 14 – Sheet Membrane Air Barriers.
4. Section 07 54 23 – TPO Roofing.
5. Section 07 92 00 - Joint Sealers.
6. Section 08 41 13 – Aluminum Framed Entrances and Storefronts.
7. Section 10 73 16 - Canopies

1.2 REFERENCES

A. ASTM International (ASTM):

1. B 32 - Solder Metal.
2. B 370 - Copper Sheet and Strip for Building Construction.

B. Copper Development Association (CDA) - Contemporary Copper, A Handbook of Sheet Copper Fundamentals, Design, Details and Specifications.


1.3 SUBMITTALS

A. Submit manufacturer’s technical information and installation instructions for:

1. Each specified sheet metal material and fabricated product, indicating that materials meet standards specified herein.
2. Solder and flux.

B. Shop Drawings showing layout, profiles, method of joining, and anchorage details, including major counter-flashings and trim/fascia units. Show expansion joint details where applicable and waterproof connections to adjoining work. Indicate types and thicknesses of metal and dimensions. Provide layouts at ¼-inch scale and details at 3-inch scale.
C. Samples: Each material and profile proposed for use; minimum 12 inches long.

1.4 PROJECT CONDITIONS

A. Coordinate work of this Section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of work and protection of materials and finishes.

B. Do not form sheet metal at ambient temperatures less than 50 degrees F.

C. Do not apply moisture barrier at ambient or surface temperatures less than 40 degrees F.

PART 2 - PRODUCTS

2.1 COUNTERFLASHING, BASE FLASHING, PITCH POCKETS

A. Sheet Steel with Aluminum-Zinc Alloy Coating: Galvalume Sheet Metal complying with ASTM653 with G90 coating.
   1. Thickness: 24 gauge.

2.2 CONCEALED FLASHINGS AT OPENINGS

A. Stainless Steel Sheet: Type 304, non-magnetic, complying with ASTM A167.
   1. Thickness: 24 gauge.

2.3 ACCESSORIES

A. Flashing Nails: Threaded nails
   1. Non-Ferrous Metal: Non-magnetic stainless steel slater’s nails, minimum 3/8 inch head.
   2. Ferrous Metal: Hot-dipped galvanized, minimum 3/8 inch head.

B. Screws: Thread design to meet application, add minimum 5/8 inch diameter EPDM integral washer where exposed to weather.
   1. Non-Ferrous Metal: #12, non-magnetic stainless-steel screws
   2. Ferrous Metal: #12 hot-dipped galvanized or polymer coating steel screw. With head designed to meet application.

C. Masonry Screws: ¼ inch diameter, galvanized, with polymer finish; slotted hex washer head with minimum 5/8 inch EPDM washer; Tapcon by Builex or approved substitute.

D. Pop Rivets: Full stainless steel, including mandrel; in size to meet application.

E. Fastener lengths as required to penetrate:
   1. Minimum 1 inch, maximum 1 ½ inch into masonry.
   2. Minimum 1 ¼ inch, or through wood receiving members
   3. Minimum ½ inch through sheet metal and steel receiving members.

F. Miscellaneous Materials: Provide sheet metal clips, straps, anchoring devices and similar accessory units for installation of the work that match, or are compatible with, the material being installed. Provide miscellaneous metal accessories in sizes and gauges as required for proper performance.

G. Joint Sealers: Specified in Section 07 92 00.
2.4 FABRICATION


B. Pre tin edges of copper sheet.

C. Solder shop formed joints. After soldering, remove flux and wash clean.

D. Fabricate corners in single units with minimum 18 inch long legs.

E. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

F. Form sections accurate to size and shape, square and free from distortion and defects.

G. Provide for thermal expansion and contraction in sheet metal:
   1. Provide expansion joints in sheet metal exceeding 15 feet in running length.
   2. Place expansion joints at 10 feet on center maximum 2 feet from corners and intersections.
   3. Joint width: Consistent with types and sizes of materials, minimum width ¼”.

H. Unless otherwise indicated, provide minimum 3/4 inch wide flat lock seams; lap in direction of water flow.

I. Fabricate cleats and starter strips of same material as sheet metal.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine the substrate and the conditions under which work is to be performed, and do not proceed until unsatisfactory conditions have been corrected. Surfaces are to be clean, even, smooth, dry and free from defects and projections which may adversely affect the installation.

3.2 INSTALLATION

A. Install flashings and sheet metal as indicated and in accordance with SMACNA Manual and CDA Handbook.

B. Install cleats and starter/edge strips before starting installation of sheet metal.

C. Secure flashings with concealed fasteners where possible.

D. Apply plastic cement between metal and felt flashings.

E. Fit flashings tight, with square corners and surfaces true and straight.

F. Seam and seal field joints.

G. Separate dissimilar metals with bituminous coating or non-absorptive gaskets.

H. Reglets:
   1. Install reglets true to line and level. Seal top of surface mounted reglet with joint sealer.
   2. Install flashings into reglets to form tight fit. Secure with lead or plastic wedges at 9 inches on center maximum. Seal remaining space with backer rod and joint sealer.
I.  Apply joint sealers as specified in Section 07 92 00.

3.3 CLEANING

A. Clean sheet metal; remove slag, flux, stains, spots, and minor abrasions without etching surfaces.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Joints in or between fire-resistance-rated constructions.

1.2 ACTION SUBMITTALS
A. Product Data: For each type of product.
B. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.

1.3 INFORMATIONAL SUBMITTALS
A. Product test reports.

1.4 CLOSEOUT SUBMITTALS
A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.5 QUALITY ASSURANCE
A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS
A. Fire-Test-Response Characteristics:
   1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
   2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
      a. Joint firestopping systems shall bear classification marking of a qualified testing agency.
         1) UL in its "Fire Resistance Directory."
2.2 JOINT FIRESTOPPING SYSTEMS

A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E 1966 or UL 2079.

1. ** Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
   a. 3M Fire Protection Products
   b. Hilti, Inc.
   c. Roxul Inc
   d. Tremco, Inc.

2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.

3. L-Rating: Not exceeding $5.0\text{ cfm/ft.}$ ($0.00775\text{ cu. m/s x m}$) of joint at both ambient and elevated temperatures.

C. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

D. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

B. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

C. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

   1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

D. Install elastomeric fill materials for fire-resistive joint systems by proven techniques to produce the following results:

   1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
   2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.2 IDENTIFICATION

A. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

2. Contractor's name, address, and phone number.
3. Designation of applicable testing agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.3 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2393.

B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.

C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

END OF SECTION
SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Joint backup materials.
   2. Sealers.

B. Related Sections:
   1. Division 1: Administrative, procedural, and temporary work requirements.
   2. Section 04 01 20 – Masonry Restoration.
   3. Section 05 55 00 – Metal Fabrications.
   4. Section 06 41 00 – Custom Cabinets.
   5. Section 06 46 00 – Wood Trim.
   6. Section 07 62 00 – Sheet Metal Flashing.
   7. Section 08 11 13 – Hollow Metal Doors and Frames for sealing joints between door frame and adjacent construction.
   8. Section 08 31 13 – Access Doors and Frames.
   9. Section 08 41 13 – Aluminum Framed Entrances and Storefronts.
   10. Section 09 29 00 – Gypsum Board Assemblies for sealing concealed perimeter joints of gypsum board partitions to reduce sound transmission.
   11. Section 09 30 13 – Tile for sealing tile joints.
   12. Section 09 91 00 – Painting and Finishing.
   13. Section 12 36 61 – Quartz Surfacing Countertops for sealing between countertop and adjacent construction.
   14. Section 22 40 00 – Plumbing Fixtures for sealing around plumbing fixtures.

1.2 REFERENCES

A. ASTM International (ASTM):
   1. C 790 - Use of Latex Sealing Compounds.
   2. C 804 - Use of Solvent-Release Type Sealants.

1.3 SUBMITTALS

A. Product Data: Indicate sealers, primers, backup materials, bond breakers, and accessories proposed for use.

B. Samples:
   1. Sealer samples showing available colors.
   2. 6 inch long joint backup material samples.
1.4 PROJECT CONDITIONS
   A. Do not apply sealers at temperatures below 40 degrees F unless approved by sealer manufacturer.

1.5 WARRANTY
   A. Provide 2 year warranty including coverage for exterior sealers and accessories that fail to provide air and water tight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
   A. Acceptable Manufacturers:
      1. Degussa Building Systems. (www.degussabuildingsystems.com)
      2. Dow Corning Corp. (www.dowcorning.com)
      3. GE Silicones. (www.gesilicones.com)
      4. Pecora Corp. (www.pecora.com)
      5. Sika Corp. (www.sikausa.com)
      6. Tremco, Inc. (www.tremcosealants.com)
   B. Substitutions: Under provisions of Division 1.

2.2 MATERIALS
   A. Joint Sealer Type 1:
      1. ASTM C 920, Type M, Grade P, multi component polyurethane, self leveling.
      3. Color: To be selected from manufacturer's full color range.
   B. Joint Sealer Type 2:
      1. ASTM C 920, Type M, Grade NS, multi component polyurethane.
      2. Shore A hardness: Between 45 and 50.
      4. Color: To be selected from manufacturer's full color range.
   C. Joint Sealer Type 3:
      1. ASTM C 920, Type M, Grade NS, multi component polyurethane, non sag.
      2. Movement capability: Plus or minus 50 percent.
      3. Colors: To be selected from manufacturer's full color range.
   D. Joint Sealer Type 4:
      1. ASTM C 834, single component acrylic latex, non sag.
      2. Movement capability: Plus or minus 7-1/2 percent.
   E. Joint Sealer Type 5:
      1. ASTM C 920, Type S, Grade NS, single component silicone, non sag, mildew resistant.
      3. Colors: To be selected from manufacturer's full color range.
F. Joint Sealer Type 6:
   1. ASTM C834, single component acrylic latex, non sag, non-hardening, recommended by manufacturer for acoustical applications.
   2. Movement capability: Plus or minus 7-1/2 percent.

2.3 ACCESSORIES
A. Primers, Bondbreakers, and Solvents: As recommended by sealer manufacturer.
B. Joint Backing:
   1. ASTM C 1330, closed cell polyethylene foam, preformed round joint filler, non absorbing, non staining, resilient, compatible with sealer and primer, recommended by sealer manufacturer for each sealer type.
   2. Size: Minimum 1.25 times joint width.

2.4 MIXES
A. Mix multiple component sealers in accordance with manufacturer’s instructions.
   1. Mix with mechanical mixer; prevent air entrainment and overheating.
   2. Continue mixing until color is uniform.

PART 3 - EXECUTION

3.1 PREPARATION
A. Remove loose and foreign matter that could impair adhesion. If surface has been subject to chemical contamination, contact sealer manufacturer for recommendation.
B. Clean and prime joints in accordance with manufacturer’s instructions.
C. Protect adjacent surfaces with masking tape or protective coverings.
D. Sealer Dimensions:
   1. Minimum joint size: 1/4 x 1/4 inch.
   2. Joints 1/4 to 1/2 inch wide: Depth equal to width.
   3. Joints over 1/2 inch wide: Depth equal to one half of width.

3.2 APPLICATION
A. Apply products in accordance with manufacturer’s instructions.
B. Perform installation in accordance with ASTM C 804 for solvent release and ASTM C 790 for latex base sealers.
C. Install joint backing to maintain required sealer dimensions. Compress backing approximately 25 percent without puncturing skin. Do not twist or stretch.
D. Use bondbreaker tape where joint backing is not installed.
E. Fill joints full without air pockets, embedded materials, ridges, and sags.
F. Tool sealer to smooth profile.
G. Apply sealer within recommended temperature range. Consult manufacturer when sealer cannot be applied within these temperature ranges.

3.3 CLEANING

A. Remove masking tape and protective coverings after sealer has cured.

B. Clean adjacent surfaces.

3.4 SEALER SCHEDULE

<table>
<thead>
<tr>
<th>JOINT LOCATION OR TYPE</th>
<th>SEALER TYPE</th>
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<tbody>
<tr>
<td>Exterior Joints:</td>
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<tr>
<td>Horizontal joints subject to pedestrian or vehicular traffic:</td>
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<tr>
<td>Slopes less than ¼ inch per foot</td>
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</tr>
<tr>
<td>Slopes of ¼ inch per foot or more</td>
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<td>Vertical joints and horizontal non-traffic bearing joints</td>
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<tr>
<td>Interior Joints:</td>
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<td>Horizontal joints subject to pedestrian traffic</td>
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<tr>
<td>Joints in toilet rooms and around countertops</td>
<td>5</td>
</tr>
<tr>
<td>Joints subject to thermal movement</td>
<td>3</td>
</tr>
<tr>
<td>Joints in acoustical assemblies</td>
<td>6</td>
</tr>
<tr>
<td>Other joints</td>
<td>4</td>
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</tbody>
</table>

END OF SECTION
SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Interior and exterior non-rated and rated steel door assemblies.
B. Related Sections:
   1. Division 1: Administrative, procedural, and temporary work requirements.
   2. Section 08 71 00 – Door Hardware.
   3. Section 06 10 00 – Rough Carpentry.
   4. Section 09 91 00 – Painting and Finishing.

1.2 REFERENCES
A. ASTM International (ASTM) A 366 - Steel Sheet, Carbon, Cold-Rolled, Commercial Quality.
B. Door Hardware Institute (DHI) - Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.
D. Steel Door Institute (SDI) 100 - Recommended Specifications - Standard Steel Doors and Frames.
E. Underwriters Laboratories (UL) 10C - Standard for Positive Pressure Fire Tests of Door Assemblies.

1.3 SUBMITTALS
A. Product Data: Show elevations, dimensions, gages of metal, hardware reinforcing gages and locations, anchor types, and data indicating compliance with indicated requirements.
B. Shop Drawings: Indicate locations, elevations, dimensions, model designations, fire ratings, and anchoring details.
C. Door Schedule: Use same reference designations indicated on drawings in preparing schedule for doors and frames.

1.4 QUALITY ASSURANCE
A. Doors: SDI 100, Grade II - Heavy Duty, Model 1 - Full Flush.
B. Frames: SDI 100, Grade II - Heavy Duty.
C. Fire Door and Frame Construction: Conform to UL 10C.
D. Installed Fire Rated Door and Frame Assemblies: Conform to NFPA 80.

1.5 DELIVERY, STORAGE AND HANDLING
A. Ship door frames with removable angle spreader; do not remove until frame is installed.
B. Store doors upright in protected, dry area, off ground or floor, with at least 1/4 inch space between individual units.

C. Do not cover with non vented coverings that create excessive humidity.

D. Remove wet coverings immediately.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Ceco Door Products.
   2. Curries Company.

B. Substitutions: Under provisions of Division 1.

2.2 REGULATORY REQUIREMENTS

A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
   1. Smoke and Draft Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

2.3 INTERIOR HOLLOW-METAL DOORS AND FRAMES

A. Heavy-Duty Doors and Frames: SDI A250.8, Level 2, at locations indicated in the Door Schedule.

B. Physical Performance: Level B according to SDI A250.4.

C. Doors:
   1. Type: As indicated in the Door Schedule.
   2. Thickness: 1-3/4 inches
   3. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch.
   4. Edge Construction: Model 2, Seamless.
   5. Core: Polyurethane.

D. Frames:
   1. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch.
   2. Construction: Full profile welded.

E. Exposed Finish: Prime for field painting.

2.4 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

A. Heavy-Duty Doors and Frames: SDI A250.8, Level 2, at locations indicated in the Door Schedule.

B. Physical Performance: Level B according to SDI A250.4.

C. Doors:
   1. Type: As indicated in the Door Schedule.
2. Thickness: 1-3/4 inches
3. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch, with minimum A40 coating.
4. Edge Construction: Model 2, Seamless.
5. Core: Polyurethane.

D. Frames:
1. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 with minimum A40 coating.
2. Construction: Full profile welded.

E. Exposed Finish: Prime for field painting.

2.5 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.

D. Frame Anchors: ASTM A879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
   1. For anchors build into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.

F. Power-Actuated Fasteners in Concrete: From corrosion-resistant materials.

G. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.

H. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat.

2.6 FABRICATION

A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical fit and assemble units in manufacturer’s plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factor assembled before shipment.

B. Hollow-Metal Doors:
   1. Exterior Doors: Provide weep-hole openings in bottoms or exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.

C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
   1. Provide countersunk, flat-or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
   2. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
   3. Floor Anchors: Weld anchors to bottoms of jamb with at least four spot welds per anchor.
   4. Jamb Anchors: Provide number and spacing of anchors as follows:
a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches O.C., to match coursing, and as follows:

(1) Two anchors per jamb up to 60 inches high.
(2) Three anchors per jamb from 60 to 90 inches high.
(3) Four anchors per jamb from 90 to 120 inches high.
(4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
b. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches O.C.

D. Hardware Preparation: Factory prepare hollow-metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortise, and surface-mounted door hardware.
2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

2.7 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer’s standard primer.


PART 3 - EXECUTION

3.1 INSTALLATION

A. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set.
   a. At fire-rated openings, install frames according to NFPA 80.
   b. At storm shelter openings, install frames according to ICC500/FEMA 361.
   c. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
   d. Install frames with removable stops located on secure side of opening.
   e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
   f. Check plumb, square, and twist of frames. Shim as necessary to comply with installation tolerances.
   g. Field apply bituminous coatings to backs of frames that will be filled with grout containing anti-freezing agents.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
   a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.
6. In-Place Concrete or Masonry Constructions: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

7. In-Place Metal or Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.

8. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
   a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

B. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Steel Doors:
   a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
   b. Between Edges of Pairs of Doors: 1/8 inch to ¼ inch plus or minus 1/32 inch.
   c. At Bottom of Door: 5/8 inch plus or minus 1/32 inch.
   d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.

3.2 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow-metal work immediately after installation.

C. Prime-Coat Touch-up: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touch-up compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surface Touch-up: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

E. Tough-up Painting: Cleaning and touch-up painting of abraded areas of paint are specified in painting Section.

END OF SECTION
SECTION 08 14 16

FLUSH WOOD DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Interior High-pressure Decorative Laminate Faced Doors.
   1. Flush solid-core high-pressure decorative laminate doors.

1.2 RELATED SECTIONS

A. Section 08 11 13 – Hollow Metal Doors and Frames for metal door frames.
B. Section 08 71 00 - Door Hardware
C. Section 08 80 00 – Glazing for vision panels.

1.3 REFERENCES

A. ANSI A208.1 - Particleboard.
C. ASTM E 413 - Classification for Rating Sound Insulation.
D. AWI/AWMAC/WI Architectural Woodwork Standards, Section 9 - Doors.
E. NEMA LD3 - High Pressure Decorative Laminates.
F. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.
G. UBC 7-2-1997/UL 10C - Positive Pressure Fire Tests of Door Assemblies.

1.4 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures.
B. Product Data: Submit manufacturer's product data, including door construction description and WDMA I.S.1-A and AWS classifications.
C. Schedules: Submit manufacturer's schedules, including door dimensions, cutouts, high-pressure decorative laminate selection, and hardware. Reference individual door numbers as indicated on the Drawings.
D. Samples
   1. Submit manufacturer’s door construction samples for door model specified.
   2. Submit manufacturer's sample chip with color and finish number.
E. Test Reports: Submit manufacturer's test results of STC ratings from testing performed by independent testing agency for sound-retardant doors.
F. Manufacturer's Certification: Submit manufacturer's certification that doors comply with specified requirements and are suitable for intended application.
G. Cleaning Instructions: Submit manufacturer's cleaning instructions for doors.
H. Warranty: Submit manufacturer's standard warranty.

1.5 QUALITY ASSURANCE

A. Tolerances for Warp, Telegraphing, Squareness, and Prefitting Dimensions: WDMA I.S.1-A and AWS.
B. Identifying Label: Each door shall bear identifying label indicating:
   1. Door manufacturer.
2. Order number.
3. Door number.
4. Fire rating, if applicable.

C. Environmental Responsibility: Provide doors manufactured with the following environmentally responsible components:
   1. Core:
      a. Structural Composite Lumber Core:
         i. Forest Stewardship Council (FSC) certified.
         ii. No added urea-formaldehyde
   2. Composite Crossband:
      a. High-Density Fiberboard (HDF):
         i. Forest Stewardship Council (FSC) certified.
         ii. No added urea-formaldehyde
   3. Stiles and Rails:
      a. Structural Composite Lumber (SCL):
         i. Forest Stewardship Council (FSC) certified.
         ii. No added urea-formaldehyde

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivery:
   1. Deliver doors to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
   2. Package doors individually in polybags.

B. Storage:
   1. Store doors in accordance with manufacturer's instructions.
   2. Store doors in clean, dry area indoors, protected from damage and direct sunlight.
   3. Store doors flat on level surface.
   4. Do not store doors directly on concrete.
   5. Keep doors completely covered. Use covering which allows air circulation and does not permit light to penetrate.
   6. Store doors between 50 and 90 degrees F (10 and 32 degrees C) and 25 to 55 percent relative humidity.

C. Handling:
   1. Handle doors in accordance with manufacturer's instructions.
   2. Protect doors and finish during handling and installation to prevent damage.
   3. Handle doors with clean hands or clean gloves.
   4. Lift and carry doors. Do not drag doors across other doors or surfaces.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not subject doors to extreme conditions or changes in temperature or relative humidity in accordance with WDMA I.S.1-A.

1.8 WARRANTY

A. Warrant solid core, interior doors for life of installation against warpage, delamination, and defects in materials and workmanship.
B. Defects noted during warranty period shall be corrected at no cost to Owner. Corrective work shall include labor and material for repair, replacement, refinishing, and rehanging as required.
PART 2 PRODUCTS

2.1 MANUFACTURER

A. Available Manufacturer’s: Subject to compliance with requirements, provide materials by one of the following:

1. Algoma Hardwoods, Inc.
3. VT Industries, Inc.
4. Or approved equal.

2.2 GENERAL

A. High-Pressure Decorative Laminates: NEMA LD3.
   1. Face laminate doors with high-pressure decorative laminates.
   2. Nominal Minimum Thickness for Faces and Vertical Edges: 0.048 inch.
   3. Laminate Selection: Standard products of Formica, Nevamar, Pionite, Wilsonart, or equal.
   5. Grade: General purpose, horizontal grade.

B. Vision Panels:
   1. VT Industries steel vision frame.
   2. Style: As indicated on the Drawings.
   3. Finish: Custom finish to match door frame.

C. Glazing: As specified in Section 08 00 00.

2.3 FLUSH SOLID-CORE HIGH-PRESSURE DECORATIVE LAMINATE DOORS

A. Flush Solid-Core High-Pressure Decorative Laminate Doors: Heritage Collection by VT Industries or approved equal.
   1. Model:
      a. 808H, SCLC-HPDL-5, structural composite lumber core, non-rated

   2. Compliance: WDMA I.S.1-A.
      a. Aesthetic Grade: Premium.
      b. Duty Level: Extra heavy duty
      c. SCLC-HPDL-5

   3. Seven-Ply and Non-Bonded Core Construction: Not acceptable.


   5. STC Rating:

   6. Stiles:
      a. 1-3/8 inches wide, before prefitting.
      b. Structural composite lumber (SCL).
      c. High-pressure decorative laminate before face laminates stile edges

   7. Rails:
      a. Structural composite lumber (SCL).

   8. Core:
      a. Material: Structural composite lumber (SCL)
      c. Composite Crossband:
         i. Apply to core in hot press using Type I, exterior, water-resistant adhesive.
         ii. Exposed Crossbanding: Not allowed along stile edges.

   9. Door Assembly:
      a. Stiles and rails bonded to core.
      b. Monolithically sand core assembly to ensure minimum telegraphing of core components.
10. Laminates:
   a. Apply to core in hot press using Type I, exterior, water-resistant adhesive.
   b. 5-ply construction

11. Positive Pressure:
   a. Where UBC 7-2-1997/UL 10C standards for positive pressure apply, doors shall be constructed in accordance with Category A guidelines as published by Intertek/Warnock Hersey.
   b. Smoke Gasketing: Apply smoke gasketing around frame perimeter and between door and pairs to meet Smoke (S) rating.
   c. Intertek/Warnock Hersey Category A Guidelines: Edge sealing systems not allowed on frames.

12. Electronic Barcode: "VTsmartdoor" barcode technology:
   a. Location: Fire label, hinge stile of doors.
   b. Provide fire-rated door assembly information required for Owner's annual fire-door inspection in accordance with NFPA 80, Paragraph 5.2.1.

2.4 FABRICATION

   A. Stile Edges: Apply laminate edges before application of face laminates.
   B. Prefit Doors:
      1. Prefit and bevel doors at factory to fit openings.
      2. Prefit Tolerances: WDMA I.S.1-A.
   C. Factory-machine doors for mortised hardware, including pilot holes for hinge screws and lock fronts required.
   D. Top and Bottom Rails: Factory sealed.

PART 3 EXECUTION

3.1 EXAMINATION

   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.

3.2 PREPARATION

   A. Allow doors to become acclimated to building temperature and relative humidity for a minimum of 24 hours before installation.

3.3 INSTALLATION

   A. Install doors in accordance with manufacturer's instructions.
   B. Install doors at locations indicated on the Door Schedule.
   C. Install doors plumb, level, and square.
   D. Install door hardware as specified in Section 08 71 00.

3.4 ADJUSTING

   A. Adjust doors to swing freely, without binding in frame.
   B. Adjust hardware to operate properly.
   C. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.
   D. Remove and replace damaged doors that cannot be successfully repaired, as determined by Architect.
3.5 CLEANING

A. Clean doors promptly after installation in accordance with manufacturer's instructions.
B. Do not use harsh cleaning materials or methods that could damage finish.

3.6 PROTECTION

A. Protect installed doors from damage during construction.

END OF SECTION
SECTION 08 31 13
ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY
A. Section includes:
   1. Fire rated and non-fire rated wall and ceiling access panels as required by other Sections for access to concealed equipment.
   2. Related hardware and attachments.
B. Related Sections:
   1. Section 06 10 00 – Rough Carpentry for furring, blocking, and other carpentry work not exposed to view.
   2. Section 09 29 00 – Gypsum Board Assemblies for wall and ceiling construction.
   3. Section 09 91 00 – Painting and Finishing for final finishing.
   4. Division 20 – Mechanical & Plumbing Requirements.
   5. Division 22 – Plumbing.
   6. Division 23 – Mechanical.
   7. Division 26 – Electrical.

1.2 ACTION SUBMITTALS
A. Product Data: For each type of door and frame indicated. Include construction details relative to materials, individual components and profiles, finishes, and fire ratings (if required) for access doors and frames.
B. Samples: For each type of access door and frame and for each finish specified.
C. Product Schedule: Provide complete door and frame schedule, including types, general locations, sizes, construction details, latching or locating provisions, and other data pertinent to installation.

1.2 QUALITY ASSURANCE
A. Single Source Responsibility: Obtain access door and panel units, and frames for entire Project from one source and one single manufacturer.
B. Size Variations: Obtain Architect’s acceptance and approval of manufacturer’s standard size units that may vary slightly from sizes indicated on Drawings.
C. Coordination: Provide inserts and anchoring devices that will be built into other Work for installation of access door assemblies. Coordinate delivery with other Work to avoid delay.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS
A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, according to NFPA 252 or UL 10B.
2.2 ACCESS DOORS AND FRAMES

A. Flush Access Doors with Exposed Flanges and Concealed Hinge:

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
   b. Milcor; Commercial Products Group of Hart & Cooley, Inc.
   c. Nystrom, Inc.

2. **Basis of Design:** NT Architectural as manufactured by Nystrom, Inc.

3. **Description:** Face of door flush with frame, with exposed flange and concealed hinge.
4. **Locations:** Wall and ceiling, dry wall.
5. **Metallic-Coated Steel Sheet for Door:** 14 gage galvannealed steel.
6. **Frame Material:** 16 gage galvannealed steel, 1 inch flange at perimeter.
7. **Latch and Lock:** Latch bolt, key operated.
8. **Finish:** Galvanized, bonderized steel, with white baked on powder coat finish.

2.3 FIRE-RATED ACCESS DOORS AND FRAMES

A. Fire-Rated, Flush Access Doors with Exposed Flanges

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
   b. Milcor; Commercial Products Group of Hart & Cooley, Inc.
   c. Nystrom, Inc.

2. **Basis of Design:** IT as manufactured by Nystrom, Inc.

3. **Description:** Door face flush with frame, uninsulated; with exposed flange, self-closing door, and concealed hinge.
4. **Locations:** Wall and ceiling, wall board.
5. **Fire-Resistance Rating:** Not less than that of adjacent construction.
6. **Temperature-Rise Rating:** 250 deg F (139 deg C) at the end of 30 minutes.
7. **Metallic-Coated Steel Sheet for Door:** 20 gage galvannealed steel.
8. **Frame Material:** 16 gage galvannealed steel.
9. **Latch and Lock:** Self-latching door hardware operated by key.
10. **Finish:** Factory white powder coat primed.

2.4 MATERIALS

A. **Steel Plates, Shapes, and Bars:** ASTM A 36/A 36M.

B. **Metallic-Coated Steel Sheet:** ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

C. **Frame Anchors:** Same material as door face.

D. **Inserts, Bolts, and Anchor Fasteners:** Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.
2.5 FABRICATION

A. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

B. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

C. Latch and Lock Hardware:
   1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
   2. Keys: Furnish two keys per lock and key all locks alike.

2.6 FINISHES

A. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
   1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
   2. Factory Finished: Apply manufacturer's standard baked-enamel or powder-coat finish immediately after cleaning and pretreating, with minimum dry-film thickness of 1 mil (0.025 mm) for topcoat.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION
SECTION 08 33 13
OVERHEAD COILING COUNTER DOOR

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Overhead Coiling Counter Doors, manually operated.

1.2 RELATED SECTIONS

A. Section 06 41 00 – Custom Cabinets for stainless steel clad counter.
B. Section 08 11 13 – Hollow Metal Doors and Frames for door frame.
C. Section 09 29 00 – Gypsum Board Assemblies.

1.3 REFERENCES

A. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
B. ASTM A 666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00.
B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Details of construction and fabrication.
   4. Installation methods.
C. Shop Drawings: Include detailed plans, elevations, details of framing members, required clearances, anchors, and accessories. Include relationship with adjacent construction.
D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) long, representing actual product, color, and patterns.
F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
1.5 QUALITY ASSURANCE
   A. Manufacturer Qualifications: Company specializing in performing Work of this section with a minimum of five years experience in the fabrication and installation of security closures.
   B. Installer Qualifications: Company specializing in performing Work of this section with minimum three years and approved by manufacturer.
   C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
      1. Install in areas designated by Architect.
      2. Do not proceed with remaining work until workmanship and installation is approved by Architect.
      3. Refinish mock-up area as required to produce acceptable work.

1.6 DELIVERY, STORAGE, AND HANDLING
   A. Store products in manufacturer's unopened packaging until ready for installation.
   B. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.
   C. Store materials in a dry, warm, ventilated weathertight location.

1.7 PROJECT CONDITIONS
   A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.8 COORDINATION
   A. Coordinate Work with other operations and installation of adjacent finish materials to avoid damage to installed materials.

1.9 WARRANTY
   A. Warranty: Manufacturer's limited door warranty for 2 years for all parts and components.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
   A. Acceptable Manufacturer: Overhead Door Corp., 2501 S. State Hwy. 121, Suite 200, Lewisville, TX 75067. ASD. Tel. Toll Free: (800) 275-3290. Phone: (469) 549-7100. Fax: (972) 906-1499. Web Site: www.overheaddoor.com. E-mail: info@overheaddoor.com.
   B. Substitutions: Not permitted.
   C. Requests for substitutions will be considered in accordance with provisions of Section 01 63 10.

2.2 OVERHEAD COILING STEEL COUNTER DOORS
   A. Anodized Aluminum Counter Doors: Overhead Door Corporation 652 Series.
      1. Wall Mounting Condition:
         a. Between jambs mounting.
      2. Curtain: Interlocking slats, Type F-158 fabricated of anodized aluminum. Endlocks attached to alternate slats to maintain curtain alignment and prevent lateral slat movement.
3. Finish:
   a. Anodized Finish:
      1) Slats and hood dark bronze anodized aluminum.


5. Guides: Extruded aluminum.
   a. Finish: PowderGuard Weathered finish with iron/black powder.

6. Brackets: Steel plate to support counterbalance, curtain and hood.

7. Counterbalance: Helical torsion spring type housed in a steel tube or pipe barrel.

8. Hood: Provided with intermediate support brackets as required and fabricated of:
   a. Aluminum.

9. Operation:

10. Locking:
     a. Slide bolt locks suitable for use with padlock.

**PART 3 - EXECUTION**

3.1 **EXAMINATION**

A. Verify opening sizes, tolerances and conditions are acceptable.

B. Examine conditions of substrates, supports, and other conditions under which this work is to be performed.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 **PREPARATION**

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 **INSTALLATION**

A. Install in accordance with manufacturer's instructions.

B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

E. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07 92 00.

F. Install perimeter trim and closures.

3.4 **ADJUSTING**

A. Test for proper operation and adjust as necessary to provide proper operation without binding or distortion.
B. Adjust hardware and operating assemblies for smooth and noiseless operation.

3.5 CLEANING

A. Clean curtain and components using non-abrasive materials and methods recommended by manufacturer.

B. Remove labels and visible markings.

C. Touch-up, repair or replace damaged products before Substantial Completion.

3.6 PROTECTION

A. Protect installed products until completion of project.

END OF SECTION
SECTION 08 41 13
ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 Related Documents
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 Summary
A. Section Includes:
   1. Aluminum Framed Storefront System, including glass and glazing, perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of storefront units.
   2. Aluminum Entrance, including glass and glazing, door hardware and components as required for a complete system.
B. Related Sections:
   1. Section 07 92 00 - Joint Sealants
   2. Section 08 80 00 – Glazing
   3. Section 08 71 00 – Door Hardware

1.3 Definitions
A. Definitions: For fenestration industry standard terminology and definitions refer to American Architectural Manufacturers Association (AAMA) – AAMA Glossary (AAMA AG).

1.4 Performance Requirements
A. Storefront System Performance Requirements:
   1. Wind loads: Provide storefront system; include anchorage, capable of withstanding wind load design pressures of (____) lbs./sq. ft. inward and (____) lbs./sq. ft. outward. The design pressures are based on the International Building Code; 2018 Edition.
   2. Air Infiltration: The test specimen shall be tested in accordance with ASTM E 283. Air infiltration rate shall not exceed 0.06 cfm/ft² (0.3 l/s · m²) at a static air pressure differential of 6.24 psf (300 Pa).
   3. Water Resistance: The test specimen shall be tested in accordance with ASTM E 331. There shall be no leakage at a minimum static air pressure differential of 8 psf (383 Pa) as defined in AAMA 501.
   4. Uniform Load: A static air design load of 20 psf (958 Pa) shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of L/175 of the span of any framing member. At a structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.

1.5 Submittals
A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, hardware, finishes, and installation instructions for each type of aluminum-framed storefront system indicated.
B. Shop Drawings: Include plans, elevations, sections, details, hardware, and attachments to other work, operational clearances and installation details.
C. Samples for Initial Selection: For units with factory-applied color finishes including samples of hardware and accessories involving color selection.
D. Samples for Verification: For aluminum-framed storefront system and components required.
E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for each type of aluminum-framed storefront.
F. Warranty: Special warranty specified in this Section.

G. Fabrication Sample: Of each vertical-to-horizontal intersection of aluminum-framed systems, made from 12" (304.8 mm) lengths of full-size components and showing details of the following:
   1. Joinery, including concealed welds.
   2. Anchorage.
   5. Flashing and drainage.

H. Other Action Submittals:
   1. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

1.6 Quality Assurance

A. Installer Qualifications: An installer which has had successful experience with installation of the same or similar units required for the project and other projects of similar size and scope.

B. Manufacturer Qualifications: A manufacturer capable of providing aluminum-framed storefront system that meet or exceed performance requirements indicated and of documenting this performance by inclusion of test reports, and calculations.

C. Source Limitations: Obtain aluminum-framed storefront system through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of aluminum-framed storefront system and are based on the specific system indicated. Refer to Division 01 Section “Product Requirements”. Do not modify size and dimensional requirements.
   1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockup for type(s) of storefront elevation(s) indicated, in location(s) shown on Drawings.

F. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section “Project Management and Coordination”.

1.7 Project Conditions

A. Field Measurements: Verify actual dimensions of aluminum-framed storefront openings by field measurements before fabrication and indicate field measurements on Shop Drawings.

1.8 Warranty

A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty.
   1. Warranty Period: Two (2) years from Date of Substantial Completion of the project provided however that the Limited Warranty shall begin in no event later than six months from date of shipment by manufacturer.

PART 2 - PRODUCTS

2.1 Manufacturers

A. Basis-of-Design Product:
   1. Kawneer Company Inc.
   2. Trifab™ VG 450 Framing System (Non-Thermal)
   3. System Dimensions: 1-3/4" x 4-1/2" (Match dimensions of existing storefront systems scheduled to remain)
   4. Glass: Center
   5. 350 Swing Door, Medium stile, 3 ½” vertical stile and top rail, 10” bottom rail, 13/4” depth, for high traffic applications.
B. Subject to compliance with requirements, provide a comparable product by the following:
   1. Manufacturer: Oldcastle Building Envelope.
   2. Series: FG-2000
   3. Profile dimension: 1 ¾ x 4 ½" (Match dimensions of existing storefront systems scheduled to remain)
   4. Entrance: MS-375 Standard Door and Frame

C. Substitutions: Refer to Substitutions Section for procedures and submission requirements
   1. Pre-Contract (Bidding Period) Substitutions: Submit written requests ten (10) days prior to bid date.
   2. Post-Contract (Construction Period) Substitutions: Submit written request in order to avoid storefront installation and construction delays.
   3. Product Literature and Drawings: Submit product literature and drawings modified to suit specific project requirements and job conditions.
   4. Certificates: Submit certificate(s) certifying substitute manufacturer (1) attesting to adherence to specification requirements for storefront system performance criteria, and (2) has been engaged in the design, manufacturer and fabrication of aluminum storefronts for a period of not less than ten (10) years. (Company Name)
   5. Test Reports: Submit test reports verifying compliance with each test requirement required by the project.
   6. Samples: Provide samples of typical product sections and finish samples in manufacturer's standard sizes.

D. Substitution Acceptance: Acceptance will be in written form, either as an addendum or modification, and documented by a formal change order signed by the Owner and Contractor.

2.2 Materials

A. Aluminum Extrusions: Alloy and temper recommended by aluminum storefront manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.070" (1.8 mm) wall thickness at any location for the main frame and complying with ASTM B 221: 6063-T6 alloy and temper.

B. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum framing members, trim hardware, anchors, and other components.

C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

1. Weather Seals: Provide weather stripping with integral barrier or fins of semi-rigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.

E. Sealant: For sealants required within fabricated storefront system, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

F. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of storefront members are nominal and in compliance with AA Aluminum Standards and Data.

2.3 Storefront Framing System

A. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

B. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials. Where exposes shall be stainless steel.

C. Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

D. Packing, Shipping, Handling and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
E. Storage and Protection: Store materials protected from exposure to harmful weather conditions. Handle storefront material and components to avoid damage. Protect storefront material against damage from elements, construction activities, and other hazards before, during and after storefront installation.

2.4 Glazing Systems

A. Glazing: As specified in Section 08 80 00 Glazing.

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, extruded EPDM rubber.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

E. Glazing Sealants: For structural-sealant-glazed systems, as recommended by manufacturer for joint type, and as follows:
   1. Structural Sealant: ASTM C 1184, single-component neutral-curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by a structural-sealant manufacturer for use in aluminum-framed systems indicated.
      a. Color: Black
   2. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; single-component neutral-curing formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and aluminum-framed-system manufacturers for this use.

2.5 Entrance Door Hardware

A. General: Provide manufacturer’s standard hardware fabricated from aluminum, stainless steel, or other corrosion resistant material compatible with aluminum; designed to smoothly operate, lightly close, and securely lock aluminum-framed entrance doors.

B. Standard Hardware:
   1. Weather-stripping:
      a. Meeting stiles on pairs of doors shall be equipped with an adjustable astragal utilizing wool pile with polymeric fin.
      b. The door weathering on a single acting offset pivot or butt hung door and frame (single or pairs) shall be comprised of a thermoplastic elastomer weathering on a tubular shape with a semi-rigid polymeric backing.

C. Entrance Door Hardware: As specified in Section 08 71 00 - Door Hardware.

2.6 Accessory Materials

A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Section 07 92 00 Joint Sealants.

B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30 mil (0.762 mm) thickness per coat.

2.7 Fabrication Aluminum Framed Storefront

A. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
   1. Profiles that are sharp, straight, and free of defects or deformations.
   2. Accurately fit joints; make joints flush, hairline and weatherproof.
   3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
   4. Physical and thermal isolation of glazing from framing members.
   5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

B. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
C. Storefront Framing: Fabricate components for assembly using manufacturer’s standard installation instructions.

D. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 Fabrication Aluminum Framed Entrance Doors
A. Fabricate aluminum-framed entrance doors in sizes indicated. Include a complete system for assembling components and anchoring doors.

B. Fabricate aluminum-framed glass doors that are reglazable without dismantling perimeter framing.
   1. Door corner construction shall consist of mechanical clip fastening, SIGMA deep penetration plug welds and 1 1/8” long fillet welds inside and outside of all four corners. Glazing stops shall be hook-in type with EPDM glazing gaskets reinforced with non-stretchable cord.
   2. Accurately fit and secure joints and corners. Make joints hairline in appearance.
   3. Prepare components with internal reinforcement for door hardware.
   4. Arrange fasteners and attachments to conceal from view.

C. Weather-stripping: Provide weather-stripping locked into extruded grooves in door panels or frames as indicated on manufacturer’s drawings and details.

2.9 Aluminum Finishes
A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Factory Finishing:

PART 3 - PRODUCTS

3.1 Examination
A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weather tight aluminum-framed storefront system installation.
   1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
   2. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Installation
A. Comply with Drawings, Shop Drawings, and manufacturer’s written instructions for installing aluminum-framed entrance and storefront system, hardware, accessories, and other components.

B. Install aluminum-framed door and storefront system level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weather tight construction.

D. Set sill threshold in bed of sealant, as indicated, for weather tight construction.

E. Install aluminum framed storefront system and components to drain condensation, water penetrating joints, and moisture migrating within aluminum-framed storefront system to the exterior.

F. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.
3.3 Field Quality Control

A. Field Tests: Architect shall select storefront units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured. Conduct tests for air infiltration and water penetration with manufacturer's representative present. Tests not meeting specified performance requirements and units having deficiencies shall be corrected as part of the contract amount.

1. Testing: Testing shall be performed by a qualified independent testing agency. Refer to Testing Section for payment of testing and testing requirements. Testing Standard per AAMA 503, including reference to ASTM E 783 for Air Infiltration Test and ASTM E 1105 Water Infiltration Test.
   a. Air Infiltration Tests: Conduct tests in accordance with ASTM E 783. Allowable air infiltration shall not exceed 1.5 times the amount indicated in the performance requirements or 0.09 cfm/ft², whichever is greater.
   b. Water Infiltration Tests: Conduct tests in accordance with ASTM E 1105. 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 6.24 psf (300 Pa).

B. Manufacturer's Field Services: Upon Owner's written request, provide periodic site visit by manufacturer's field service representative.

3.4 Adjusting, Cleaning, and Protection

A. Clean aluminum surfaces immediately after installing aluminum-framed storefronts. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

B. Clean glass immediately after installation. Comply with glass manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION
SECTION 08 58 00

BULLET RESISTANT SERVICE WINDOWS

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes:
   1. Interior single lite aluminum bullet resistant transaction windows.
   2. Interior multi lite bullet resistant transaction windows.

B. The publication below forms a part of this specification:
   1. UNDERWRITERS LABORATORY UL 752 9th Edition

1.2 SUBMITTALS

A. Product Data: Submit Manufacturer’s technical product data substantiating that product complies.
B. Shop drawings: Submit for fabrication and installation of windows. Include details, elevations and
   installation requirement of finish hardware and cleaning.
C. Certification: Provide printed data in sufficient detail to indicate compliance with the contract
   documents.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver windows crated to provide protection during transit and job storage
B. Inspect windows upon delivery for damage. Unless minor defects can be made to meet the
   Architect’s specifications and satisfaction, damaged parts should be removed and replaced.
C. Store windows at building site under cover in dry location.

1.4 PROJECT CONDITIONS

A. Field measurements: Check opening by accurate field measurement before fabrication. Show
   recorded measurements on shop drawings. Coordinate fabrication schedule with construction
   progress to avoid delay of work.

1.5 WARRANTY

All material and workmanship shall be warranted against defects for a period of one (1) year from the original
date of purchase.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER’S

A. Basis of design: Design is based on aluminum bullet resistant fixed windows, manufactured by
   C.R. Laurence Co., Inc. (800) 421-6144.
   1. Single lite model no.: S11W12DU
   2. Multi lite model no.: S1SWDU

2.2 MATERIALS

A. Frames: Aluminum bullet resistant frame modules shall be to the standards established by U.L.
   752 Protection Level 1. Frames are to be constructed of 6063-T5 extruded aluminum.
   Replacement of glazing shall be from the secure side of the window or wall unit and does not
require the removal of the frame from the opening. Frames must utilize testing recognized under the standards established by U.L. 752 for bullet resistant components.

B. Finish: All aluminum to be clear anodized, duranodic bronze.

C. Glazing: The glazing must be in accordance with U.L. 752 testing standards Level 1, ¾” thick polycarbonate.

D. Surround Sound: Provide for two way “natural voice” or “surround sound” communication permitted by the design of the window jambs and glazing technique. Units must be manufactured in strict accordance with the specifications, design and details. No field alterations to the construction of the units fabricated under the acceptable standards shall be allowed unless approved by the manufacturer and the architect.

D. Options:

1) Shelf: Provide 2” thick by 18” deep shelf, clad with 16 gauge stainless steel with #4 finish, with ricochet resistant deal tray.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install frames and glazing in accordance with manufacturer’s printed instructions and recommendations. Repair damaged units as directed (if approved by the manufacturer and the architect) or replace with new units.

3.2 CLEANING

A. Clean frame and glazing surfaces after installation, complying with requirements contained in the manufacturer’s instructions. Remove excess glazing sealant compounds, dirt or other substances.

3.3 PROTECTION

A. Institute protective measures required throughout the remainder of the construction period to ensure that all the windows do not incur any damage or deterioration, other than normal weathering, at the time of acceptance.

END OF SECTION
SECTION 08 71 00
DOOR HARDWARE

PART 1 – GENERAL:

1.01 SUMMARY:

A. Section includes the supply and installation of the Finish Hardware.
   1. Include the termination of all Electrified Hardware.
   2. Include field verification of any existing doors, frames or hardware.

B. Related Sections
   1. Division 1
   2. Sealants – Division 7 / Division 7
   3. Openings – Division 8 / Division 8
   4. Finishes – Division 9 / Division 9
   5. Fire Alarm – Division 13 / Division 28
   6. Electrical – Division 16 / Division 26
   7. Security – Division 16 / Division 28

1.02 REFERENCES:

A. Documents and Institutes that shall be used in estimating, detailing and installing the
   items specified.
   1. International Building Code – Current/Adopted Edition
   2. ICC/ANSI A117.1 – Accessible and Usable Building and Facilities -
      Current/Adopted Edition
   3. NFPA 70 – Current/Adopted Edition
   4. NFPA80 – Standards For Fire Doors and Fire Windows – Current/Adopted
      Edition
   6. NFPA105 – Installation of Smoke-Control Door Assemblies –
      Current/Adopted Edition
   7. ANSI - American National Standards Institute
   8. BHMA – Builders Hardware Manufacturers Association
   9. UL – Underwriters Laboratory
   10. DHI – Door and Hardware Instatitute
   11. Texas Accessibility Standards – Current Adopted Edition
   12. Local Building Codes

1.03 SUBMITTALS

A. Comply with pertinent provisions of Division 01.

B. Finish Hardware Schedule to be in vertical format to include:
   1. Heading #/Hardware Set
   2. Door #, Location, Hand, Degree of Opening, Door Size and Type, Frame
      Size and Type, Fire Rating
   3. Quantity, type, style, function, product, product number, size, fasteners, finish
      and manufacturer of each hardware item.
   4. Location of hardware set cross-referenced to indications on Drawings both
      on floor plans and in door and frame schedule.
   5. Keying schedule
6. Title Sheet, Index, Abbreviations, Manufacturers List, Template List and Templates.
7. Mounting locations for hardware.
8. Explanation of abbreviations, symbols, and codes contained in schedule.
9. Date of the Finish Hardware Specification and Drawing / Door Schedule used in completing the Finish Hardware Schedule.
10. In Name, Company and Date of Field Verification if required.
11. Door Index; include door number, heading number, and hardware group.
12. Name and phone number for local manufacturer’s representative for each product.
13. Submit in conjunction with Door and Frame Submittal.
14. Operation Description of openings with electrified hardware.

C. LEED Submittals:
1. Refer to Division 1 for any LEED submittal requirements.

D. Product Data: Provide product data in the form of a binder, manufacturer’s technical product fact sheets for each item of hardware. Include whatever information may be necessary to show compliance with requirements, including instructions for installation and for maintenance of operating parts and finish.

E. Wiring Diagrams: Provide Riser/Elevation and Point to Point Wiring Diagrams for all openings with electrified hardware. Include all information that is necessary for coordination with other trades.

F. Samples: Provide samples as requested by Owner or Architect with Heading # and Door# marked on boxes. All samples will be returned to the contractor and used on doors for which they were marked.

G. Templates: Provide templates of finish hardware items to each fabricator of doors, frames and other work to be factory or shop prepared for the installation of hardware.

H. Keying Schedule: After meeting with the Owner, a keying schedule shall be submitted using keyset symbols referenced in DHI manual "Keying Systems and Nomenclature." The keying schedule shall be indexed by door number, keyset, hardware heading number, cross keying instructions and special key stamping instructions.

I. Operations and maintenance data: At the completion of the job, provide to the Owner one hard copies or one electronic copy of an Owner’s operation and maintenance manual. The manual shall consist of a labeled hardcover three ring binder with the following technical information:
1. Title page containing: Project name, address and phone numbers. Supplier’s name, address and phone numbers.
2. Table of Contents.
3. Copy of final (file and field use/as-installed) Finish Hardware Schedule.
4. Final Keying Schedule.
5. Maintenance instruction, adjustment, and preservation of finishes for each item of hardware.
6. Catalog pages for each items of hardware.
7. Installation Instructions for each item of hardware
8. Parts List for each item of hardware.
9. As installed point to point wiring diagrams for electrified hardware.
10. Warranties include Order #.
1.04 QUALITY ASSURANCES

A. Substitutions: Request for substitutions shall not be accepted within this project. Architect, Owner and Finish Hardware Consultant have selected one (1) specified and two (2) equals listed hereinafter in the Hardware Schedule. By this selection process they have established three (3) equal products for competitive pricing, while insuring no unnecessary delays by a substitution process. If any specified product is listed as a “No Substitution” product, this product will be supplied as specified, with no alteration or request of substitution. The reason for this is to comply with the uniformity established at this project. Parts and supplies are inventoried for these particular products for ease and standardization of replacement.

B. Supplier Qualifications: Supplier shall be recognized architectural finish hardware supplier, with warehousing facilities, who have been furnishing hardware in the project vicinity for a period of not less than 2 years and who is or employs a DHI Certified AHC, DHC, DHSC or person with a minimum of 10 years of experience as a hardware supplier. This person shall be available at reasonable times during the course of the work for consultation about products hardware requirements, to the Owner, Architect and General Contractor.

C. Installer Qualifications (Mechanical Hardware): All finish hardware shall be installed by the Finish Hardware Installer with a minimum of at least two (2) years documented experience. Installer shall attend a pre-installation meeting between the General Contractor, Finish Hardware Supplier/s, hardware manufacturer's representative for locks, closers and exit devices, and all door / frame suppliers. The Finish Hardware Installer shall be responsible for the proper installation and function of all doors and hardware.

D. Installer Qualifications (Electrified Hardware): All electrified finish hardware (power source, electrified locking or control device, switching device, through wire device and monitoring device) shall be installed by an Electronic Access Control Installer licensed by the Texas Department of Public Safety. The Electrified Finish Hardware Installer shall have a minimum of at least two (2) years of documented experience. Installer shall attend a pre-installation meeting between the General Contractor, Finish Hardware Supplier/s, Electrical Contractor, Fire Alarm Contractor, Security Contractor, hardware manufacturer's representative for electrified hardware, all door / frame suppliers. The Electrified Finish Hardware Installer shall be responsible for the proper installation, termination and function of all opening with electrified hardware. Installation shall include termination of all electrified products (including the required wire to the power supply and/or junction box).

1.05 DELIVERY, STORAGE AND HANDLING

A. Marking and packaging: Mark each item or package separately, with identification related to hardware set number, door number and keyset symbol.

B. Delivery:
   1. Deliver individually packaged and properly marked finish hardware at the proper time and location to avoid any delays in construction or installation.
   2. At time of delivery, inventory hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.

C. Storage: Store hardware in enclosed, dry and locked area.
1.06 WARRANTY
   A. All finish hardware products shall be covered by a 1 year factory warranty from the date of substantial completion of the project.
   B. Supply warranty verification to the owner for all products that provide factory warranty. Warranty should include Factory Order # and date.

1.07 MAINTENANCE:
   A. Maintenance Service
      1. None
   B. Extra Materials:
      1. All extra screws, fasteners, and all special installation tools furnished with the hardware shall be turned over to the owner at the completion of the job.

PART 2 – PRODUCTS

2.01 MATERIALS
   A. Screws and Fasteners:
      1. All closers and exit devices provided for exterior doors, hollow metal doors, and all other required shall be provided with thru-bolts.
      2. All finish hardware shall be installed to manufacturer’s recommendations, using screws, attachments and installation tools provided with the hardware. No other screws or attachments are acceptable.
      3. All other products to meet door and frame conditions.
   B. Hinges:
      1. Template: Provide templated units only.
      2. Exterior: All exterior hinges shall be stainless steel base with stainless steel pin and stainless steel finish.
      3. Interior: All interior hinges steel based.
      4. Interior corrosive: All interior hinges at corrosive areas shall be stainless steel base with stainless still pin and stainless steel finish.
      5. All hinges on doors over 36” wide, with exit devices, or with push/pull shall be heavy weight.
      7. Provide non-removable pins for outswinging doors that are locked or are lockable.
      8. All hinges on doors with door closers shall be ball bearing.
      9. All hinges shall be full mortise.
      10. Size: Provide 4 ½ x 4 ½ hinges on doors up to 3’0” in width. Provide 5 x 4 ½ hinges over 3’0” to 4’0” in width. Reference manufacturers catalog for all other sizes.
      11. Number of Hinges: Provide number of hinges indicated but not less than 3 hinges for door leaf for doors 90” or less in height and one additional hinge for each 30” of additional height.
      12. Adjust hinge width as required for door, frame, trim and wall conditions to allow proper degree of opening.
      13. Provide hinges conforming to ANSI/BHMA A156.1.
      14. Provide spring hinges where specified. Provide two spring hinges and one bearing hinge per door leaf for doors 90 inches (2286 mm) or less in height.
Provide one additional bearing hinge for each 30 inches (762 mm) of additional door height.

15. Supply from the following list of manufacturers:
   Ives       IVE
   Hager      HAG
   Bommer     BOM

C. Continuous Hinges
   1. Continuous hinges to be manufactured of 6063-T6 aluminum.
   2. Continuous hinge shall be certified to ANSI 156.26, Grade 1
   3. Continuous hinge should be tested an approved UL10C.
   4. Electrified – Provide minimum 8 wire with removable panel.
   5. Provide hinges 1 inch shorter in length than nominal height of door, unless otherwise noted.
   6. Provide reinforcing for doors weighing over 450 pounds and up to 600 pounds.
   7. Supply from the following list of manufacturers:
      Ives       IVE
      Select     SEL
      Stanley    STA

D. Mortise Locks
   1. All locks on this project should be manufactured by the same manufacturer.
   2. Mortise locksets shall meet ANSI/BHMA A156.13, Series 1000, Grade 1
      Operational with all standard trims and conventional mortise cylinders.
   3. All mortise locks shall be UL Listed for 3 hour fire door. Review lock for any height restriction.
   4. Provide locks with a standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1 inch (25 mm) throw, constructed of stainless steel.
   5. Provide standard ASA strikes unless extended lip strike is necessary for frame/trim or 7/8” lip strike is necessary at pair with overlapping astragal.
   6. Provide dust box.
   7. Supply from the following list of manufacturers:
      Schlage    SCH
      Falcon     FAL
      Best       BES

E. Cylindrical Locks
   1. All locks on this project should be manufacturer by the same manufacturer.
   2. All locks shall meet the new ANSI/BHMA A156.2, Series 4000, Grade 1.
   3. All cylindrical locks shall be UL Listed for 3 hour fire door. Review lock for any height restriction.
   4. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with a 1/2 inch (13 mm) latch throw. Provide proper latch throw for UL listing at pairs.
   5. Provide standard ASA strikes unless extended lip strike is necessary for frame/trim or 7/8” lip strike is necessary at pair with overlapping astragal.
   6. Provide dust box.
   7. Lockset shall adjust to fit door thickness from 1 ¾” to 2 1/8”.
   8. Supply from the following list of manufacturers:
      Schlage    SCH
      Falcon     FAL
      Best       BES
F. Exit Devices
1. All exit device types on this project should be manufactured by the same manufacturer.
2. Exit devices are to be architectural grade touch bar type. Touchpad to extend one half of door width.
3. Mechanism case to be smooth.
4. Exit devices shall meet ANSI A156.3, Grade 1.
5. All exit devices are UL listed Panic Exit or Fire Exit Hardware.
6. All lever trim to match lock trim in design and finish.
7. Dogging: Non-rated devices are to be provided with dogging. Less dogging where shown in Hardware Sets (some exterior, electrical rooms, electrified) Cylinder dogging as shown in hardware sets.
8. Exit devices are to be supplied and installed with thru-bolts for exterior, hollow metal doors, or as required for application.
9. Provide proper power supply for exit devices as required. Coordinate with Fire Alarm, Electrical and Security Contractor.
10. Push pads shall be metal, no plastic inserts allowed.
11. Exit devices shall have a flush end cap.
12. Exit devices shall be ordered with the correct strike for application.
13. Exit devices shall be order in the proper length to meet door width.
14. Exit devices shall have deadlatching.
15. Exit device shall be provided in width/height required based on door size.
16. Install exit devices with fasteners supplied by exit device manufacturer.
17. Mount mechanism case flush on face of doors, or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits as required.
18. Provide proper concealed vertical rods for wood or hollow metal doors as required.
19. Factory or field drill weep holes for exit devices used in full exterior applications, highly corrosive areas, and where noted in the hardware sets.
20. Supply from the following list of manufacturers:
   Von Duprin   VON   35/98 Series
   Falcon     FAL
   Detex    DET

G. Flush Bolts
1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.
2. Supply from the following list of manufacturers:
   Ives     IVE
   Trimco    TRI
   Rockwood    ROC

H. Coordinators
1. Where pairs of doors are equipped with automatic flush bolts, an astragal, or other hardware that requires synchronized closing of the doors, provide bar-type coordinating device, surface applied to underside of stop at frame head.
2. Provide filler bar of correct length for unit to span entire width of opening, and appropriate brackets for parallel arm door closers and surface vertical rod.
exit device strikes. Factory-prep coordinators for vertical rod devices and hardware as required.

3. Supply from the following list of manufacturers:
   - Ives
   - Trimco
   - Rockwood

I. Pull Plates/Pulls/Push Plate
   1. Pull and Push Plates to meet ANSI 156.6 for .050" thickness.
   2. Pull and Push Plate size to 4" x 16".
   3. Pull Plate to have 10" center and 1" round on pull plate with concealed fasteners.
   4. Provide straight and offset pulls with fasteners as required
   5. Provide concealed fasteners for all applications.
   6. Prep plate for cylinder/lock as required.
   7. Supply from the following list of manufacturers
      - Ives
      - Trimco
      - Rockwood

J. Door Closers
   1. All door closers on this project should be manufactured by the same manufacturer.
   2. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
   3. Door closers shall be furnished with standard cover. Provide full cover as shown in hardware sets.
   4. Size in accordance with the manufacturers recommendations for door size and condition.
   5. Door closers shall be furnished with delayed action, hold-open as listed in the Hardware Sets.
   6. Door closers shall be mounted out of the line of sight wherever possible (i.e., room side of corridor doors, etc.) with parallel arm mounting on out swinging doors.
   7. All closer installation shall include thru bolts on exterior, hollow metal doors or where required for application.
   8. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.
   9. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
   10. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
   11. Supply from the following list of manufacturers
       - LCN
       - Falcon
       - Norton

K. Door Protection Plates
   1. Protective plates shall meet ANSI A156.6 requirements for .050 thickness.
   2. Protection plates should be fabricated from stainless steel.
3. Protection plate shall be height as shown in Hardware Sets. Width shall be 10" by 2" less than door width on single door or pair with a mullion and 1" less than door width on pair of doors without a mullion.
4. Beveled 4 edges.
5. Provide kickplate on all doors with closers, unless not required for aesthetic reasons.
6. Prep protective plates for hardware as required.
7. Supply from the following list of manufacturers:
   Ives       IVE
   Rockwood   ROC
   Trimco     TRI

L. Door Stops and Holders:
1. Supply wall stops at all openings to protect doors or door hardware. Install so lock does not lock unintentionally. Install blocking in wall where wall stop will be mounted.
2. When wall conditions do not permit use of wall stop provide floor stops with risers as needed to adjust for floor conditions.
3. When wall conditions do not permit use of wall stop provide overhead stops. Jamb mount where required to not be visible from Corridor.
5. Exterior Roof Doors: Provide heavy duty overhead stop.
6. Supply from the following list of manufacturers:
   Glynn Johnson GLY
   Rockwood ROC
   Trimco TRI

M. Silencers
1. Provide silencers on all doors without seal. 3 for single doors and 2 for pairs.
2. Provide silencers as required for frame conditions. SR64 for hollow metal frames. SR65/SR66 for wood frames.
3. At wood frames, insure height of stop is compatible with silencer.
4. Supply from the following list of manufacturer’s
   Ives       IVE
   Rockwood   ROC
   Trimco     TRI

N. Thresholds/Weatherstripping
1. Thresholds on doors in the accessible path shall conform to accessibility codes.
2. Threshold should be based on sill detail.
3. Smoke seal shall be teardrop design bulb seal.
4. Exterior seal/thresholds shall be silicone or brush as shown in hardware sets.
5. Drip strips shall protrude 2 ½” and be 4” wider than opening.
6. At S Label single doors provide seals on frame to comply with UL1784
7. At S Label pair of doors provide seals on frame and as meeting stile to comply with UL1784.
8. Automatic Door Bottom shall be mortised to comply with accessibility codes.
9. Supply from the following list of manufacturer’s
   Zero       ZER
   National Guard NGP
   Pemko PEM

2.03 KEYING:

Milam County Annex                  08 71 00 - 8 Door Hardware
Cameron, Texas
A. General: Finish Hardware Supplier shall meet in person with owner to finalize keying requirements prior to the locks and exit devices being ordered and match existing or start a new Master Key System for the project. During keying meeting all hardware functions should be reviewed with the owner to finalize lock and exit device functions. During keying meeting determine all expansion required.

B. Cylinders: Provide the correct and quantity of cylinders for all applications.

C. Keys: Provide nickel silver keys only. Furnish 2 change keys for each lock: 5 control keys: 5 master keys for each master system and 5 grandmaster keys for each grandmaster key system. Deliver all keys to Owners’ Representative.

D. Cores and keys shall be provided with identification stamping.

E. Provide construction keying / construction cores for this project with constructions keys.

F. Provide Bitting List to Owner.

2.04 KEY CONTROL:

A. Key Management: Key control shall be provided, by supplying a complete key storage and management system. Each key shall be fully cut, indexed, tagged and installed on cabinet hooks by the lock supplier and shipped with the locks. Key cabinet provided shall be wall-mounted type with capacity plus 50%.

PART 3 – EXECUTION:

3.01 EXAMINATION:

A. Examine doors, frames and related items for conditions that would prevent the proper application of any finish hardware items. Do not proceed with installation until all defects are corrected.

B. Existing Door and Frame Compatibility: Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.

C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. Follow Door and Hardware Institute Publication:
Recommended Location for Architectural Hardware for Standard Steel Doors and Frames
Recommended Location for Builder’s Hardware for Custom Steel Doors and Frames
Recommended Locations for Architectural Hardware for Wood Flush Door

B. Install each hardware item in compliance with manufacturer’s instructions and recommendations, using only fasteners provided by manufacturer.

E. Review mounting locations with Architect where required.

F. Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Closers should not be visible in corridors, lobbies and other public spaces where possible.

G. Locate power supplies in accessible location and indicate in as-builts where located.

H. Set threshold in full bed of sealant complying with requirements specified in Division 07.

I. Pre Installation meeting required with attendees to include Architect, General Contractor, Mechanical Hardware Installer, Electrified Hardware Installer, Finish Hardware Supplier and Manufacturer’s Representative for Exit Device, Locks and Closers and Door/Frame Suppliers before installation begins.

3.03 FIELD QUALITY CONTROL:

A. After installation has been completed, obtain the services of an Architectural Hardware Consultant to check for proper installation of finish hardware, according to the finish hardware schedule and keying schedule. In addition, check all hardware for adjustments and proper operation.

3.04 ADJUST AND CLEAN:

A. Adjust, clean and inspect all hardware, to ensure proper operation and function of every opening. Replace items, which cannot be adjusted to operate freely and smoothly as intended for the application made.

3.05 PROTECTION:

A. The General Contractor shall use all means at his disposal to protect all finish hardware items from abuse, corrosion and other damage until the owner accepts the project as complete.

3.06 TRAINING

A. After installation has been completed, provide training to the Owner on the operation of the Finish Hardware and programming of any electrified hardware.

3.07 HARDWARE SCHEDULE

A. These hardware set shown below are for use as a guideline. Provide hardware as required to meet the requirements of the openings, security, and code requirements.

HARDWARE SET LAYOUT

0 – Existing, No Hardware Required or Cylinders
1 – Lockset - Office
2 – Lockset – Storeroom
3 – Latchset - Privacy
4 – Latchset - Passage
5 – Lockset - Classroom
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HARDWARE GROUP NO. 101C
FOR USE ON DOOR #(S):
103B 107A.2 110A 111G.1

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-GENERAL CONTRACTOR VERIFY IN FIELD PRIOR TO BID DATE NEW HARDWARE CAN BE INSTALLED ON EXISTING DOOR/FRAME. NOTIFY ARCHITECT OF INCOMPATIBILITY. IN SUBMITTAL INCLUDE NAME, COMPANY AND DATE OF FIELD VERIFICATION.

HARDWARE GROUP NO. 201
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-DECREASE UNDERCUT ON DOOR ACCORDINGLY.

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-GENERAL CONTRACTOR VERIFY IN FIELD PRIOR TO BID DATE NEW HARDWARE CAN BE INSTALLED ON EXISTING DOOR/FRAME. NOTIFY ARCHITECT OF INCOMPATIBILITY. IN SUBMITTAL INCLUDE NAME, COMPANY AND DATE OF FIELD VERIFICATION. -GENERAL CONTRACTOR CONFIRM DOOR BOTTOM AND THRESHOLD CAN BE UTILIZED ON EXISTING DOOR TO PROVIDE SOUND CONTROL.

HARDWARE GROUP NO. 202
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102L 109Q 109R
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GENERAL CONTRACTOR VERIFY IN FIELD PRIOR TO BID DATE NEW HARDWARE CAN BE INSTALLED ON EXISTING DOOR/FRAME. NOTIFY ARCHITECT OF INCOMPATIBILITY. IN SUBMITTAL INCLUDE NAME, COMPANY AND DATE OF FIELD VERIFICATION.

HARDWARE GROUP NO. 205
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GENERAL CONTRACTOR CONFIRM THRESHOLD TYPE REQUIRED.
HARDWARE GROUP NO. 210G
FOR USE ON DOOR #(S):
101R  101X  101Y
PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

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<td>A</td>
<td>ZER</td>
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<tr>
<td>1</td>
<td>GASKETING</td>
<td>475AA-S</td>
<td>AA</td>
<td>ZER</td>
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<tr>
<td>2</td>
<td>DOOR BOTTOM</td>
<td>364AA</td>
<td>AA</td>
<td>ZER</td>
</tr>
<tr>
<td>1</td>
<td>THRESHOLD</td>
<td>655A</td>
<td>A</td>
<td>ZER</td>
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-GENERAL CONTRACTOR VERIFY IN FIELD PRIOR TO BID DATE NEW HARDWARE CAN BE INSTALLED ON EXISTING DOOR/FRAME. NOTIFY ARCHITECT OF INCOMPATIBILITY. IN SUBMITTAL INCLUDE NAME, COMPANY AND DATE OF FIELD VERIFICATION. -GENERAL CONTRACTOR CONFIRM DOOR BOTTOM AND THRESHOLD CAN BE UTILIZED ON EXISTING DOOR TO PROVIDE SOUND CONTROL.
HARDWARE GROUP NO. 341
FOR USE ON DOOR #(S):

<table>
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<tr>
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<th>MFR</th>
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<tbody>
<tr>
<td>3</td>
<td>HINGE</td>
<td>5BB1 4.5 X 4.5</td>
<td>652</td>
<td>IVE</td>
</tr>
<tr>
<td>1</td>
<td>PRIVACY LOCK</td>
<td>L9040 17A L583-363 L283-722</td>
<td>626</td>
<td>SCH</td>
</tr>
<tr>
<td>1</td>
<td>SURFACE CLOSER</td>
<td>1461 RW/PA</td>
<td>689</td>
<td>LCN</td>
</tr>
<tr>
<td>1</td>
<td>SURFACE CLOSER</td>
<td>4040XP RW/PA</td>
<td>689</td>
<td>LCN</td>
</tr>
<tr>
<td>1</td>
<td>KICK PLATE</td>
<td>8400 10&quot; X 2&quot; LDW B-CS</td>
<td>630</td>
<td>IVE</td>
</tr>
<tr>
<td>1</td>
<td>WALL STOP</td>
<td>WS406/407CCV</td>
<td>630</td>
<td>IVE</td>
</tr>
<tr>
<td>1</td>
<td>GASKETING</td>
<td>188S</td>
<td>BR</td>
<td>ZER</td>
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-GENERAL CONTRACTOR VERIFY IN FIELD PRIOR TO BID DATE NEW HARDWARE CAN BE INSTALLED ON EXISTING DOOR/FRAME. NOTIFY ARCHITECT OF INCOMPATIBILITY. IN SUBMITTAL INCLUDE NAME, COMPANY AND DATE OF FIELD VERIFICATION.

HARDWARE GROUP NO. 503
FOR USE ON DOOR #(S):

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<td>L9070T 17A</td>
<td>626</td>
<td>SCH</td>
</tr>
<tr>
<td>1</td>
<td>FSIC CORE</td>
<td>23-030</td>
<td>626</td>
<td>SCH</td>
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<tr>
<td>1</td>
<td>WALL STOP</td>
<td>WS406/407CCV</td>
<td>630</td>
<td>IVE</td>
</tr>
<tr>
<td>1</td>
<td>SILENCER</td>
<td>SR64</td>
<td>GRY</td>
<td>IVE</td>
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-GENERAL CONTRACTOR VERIFY IN FIELD PRIOR TO BID DATE NEW HARDWARE CAN BE INSTALLED ON EXISTING DOOR/FRAME. NOTIFY ARCHITECT OF INCOMPATIBILITY. IN SUBMITTAL INCLUDE NAME, COMPANY AND DATE OF FIELD VERIFICATION.

HARDWARE GROUP NO. 503SJW
FOR USE ON DOOR #(S):

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<th>MFR</th>
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<tbody>
<tr>
<td>3</td>
<td>HINGE</td>
<td>5BB1 5 X 4.5</td>
<td>652</td>
<td>IVE</td>
</tr>
<tr>
<td>1</td>
<td>CLASSROOM LOCK</td>
<td>L9070T 17A</td>
<td>626</td>
<td>SCH</td>
</tr>
<tr>
<td>1</td>
<td>FSIC CORE</td>
<td>23-030</td>
<td>626</td>
<td>SCH</td>
</tr>
<tr>
<td>1</td>
<td>OH STOP</td>
<td>90S J</td>
<td>652</td>
<td>GLY</td>
</tr>
<tr>
<td>1</td>
<td>SILENCER</td>
<td>SR64</td>
<td>GRY</td>
<td>IVE</td>
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-GENERAL CONTRACTOR VERIFY IN FIELD PRIOR TO BID DATE NEW HARDWARE CAN BE INSTALLED ON EXISTING DOOR/FRAME. NOTIFY ARCHITECT OF INCOMPATIBILITY. IN SUBMITTAL INCLUDE NAME, COMPANY AND DATE OF FIELD VERIFICATION.
### HARDWARE GROUP NO. 509R
FOR USE ON DOOR #(S):
102C

PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

<table>
<thead>
<tr>
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<th>FINISH</th>
<th>MFR</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>HINGE</td>
<td>5BB1 4.5 X 4.5</td>
<td>652</td>
<td>IVE</td>
</tr>
<tr>
<td>1</td>
<td>CLASSROOM LOCK</td>
<td>L9070T 17A</td>
<td>626</td>
<td>SCH</td>
</tr>
<tr>
<td>1</td>
<td>FSIC CORE</td>
<td>23-030</td>
<td>626</td>
<td>SCH</td>
</tr>
<tr>
<td>1</td>
<td>OH STOP</td>
<td>100S</td>
<td>630</td>
<td>GLY</td>
</tr>
<tr>
<td>1</td>
<td>FIRE/LIFE CLOSER</td>
<td>4040SE WMS 24V AC/DC (PULL SIDE)</td>
<td>689</td>
<td>LCN</td>
</tr>
<tr>
<td>1</td>
<td>KICK PLATE</td>
<td>8400 10&quot; X 2&quot; LDW B-CS</td>
<td>630</td>
<td>IVE</td>
</tr>
<tr>
<td>1</td>
<td>GASKETING</td>
<td>188S</td>
<td>BR</td>
<td>ZER</td>
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</table>

### HARDWARE GROUP NO. 700R
FOR USE ON DOOR #(S):
102B.2

PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

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<th>QTY</th>
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<tbody>
<tr>
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<td>5BB1HW 4.5 X 4.5 NRP</td>
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<td>IVE</td>
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<tr>
<td>2</td>
<td>FIRE EXIT HARDWARE</td>
<td>9847-L-F-LBR-17 (WDC @ WD)</td>
<td>626</td>
<td>VON</td>
</tr>
<tr>
<td>2</td>
<td>RIM CYLINDER</td>
<td>20-057 ICX</td>
<td>626</td>
<td>SCH</td>
</tr>
<tr>
<td>2</td>
<td>FSIC CORE</td>
<td>23-030</td>
<td>626</td>
<td>SCH</td>
</tr>
<tr>
<td>2</td>
<td>SURFACE CLOSER</td>
<td>1461 RW/PA</td>
<td>689</td>
<td>LCN</td>
</tr>
<tr>
<td>2</td>
<td>KICK PLATE</td>
<td>8400 10&quot; X 1&quot; LDW B-CS</td>
<td>630</td>
<td>IVE</td>
</tr>
<tr>
<td>2</td>
<td>WALL STOP</td>
<td>WS406/407CCV</td>
<td>630</td>
<td>IVE</td>
</tr>
<tr>
<td>1</td>
<td>MEETING STILE</td>
<td>328AA (2 PCS - 1 SET)</td>
<td>AA</td>
<td>ZER</td>
</tr>
<tr>
<td>1</td>
<td>GASKETING</td>
<td>188S</td>
<td>BR</td>
<td>ZER</td>
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### HARDWARE GROUP NO. 701R
FOR USE ON DOOR #(S):
102B.1

PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

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<tr>
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<td>FIRE EXIT HARDWARE</td>
<td>98-L-F-17</td>
<td>626</td>
<td>VON</td>
</tr>
<tr>
<td>1</td>
<td>RIM CYLINDER</td>
<td>20-057 ICX</td>
<td>626</td>
<td>SCH</td>
</tr>
<tr>
<td>1</td>
<td>FSIC CORE</td>
<td>23-030</td>
<td>626</td>
<td>SCH</td>
</tr>
<tr>
<td>1</td>
<td>SURFACE CLOSER</td>
<td>1461 RW/PA</td>
<td>689</td>
<td>LCN</td>
</tr>
<tr>
<td>1</td>
<td>KICK PLATE</td>
<td>8400 10&quot; X 2&quot; LDW B-CS</td>
<td>630</td>
<td>IVE</td>
</tr>
<tr>
<td>1</td>
<td>WALL STOP</td>
<td>WS406/407CCV</td>
<td>630</td>
<td>IVE</td>
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<tr>
<td>1</td>
<td>GASKETING</td>
<td>188S</td>
<td>BR</td>
<td>ZER</td>
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HARDWARE GROUP NO. 715
FOR USE ON DOOR #(S):
107A.1

PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

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<td>1</td>
<td>PANIC HARDWARE</td>
<td>98-NL</td>
<td>626</td>
<td>VON</td>
</tr>
<tr>
<td>1</td>
<td>RIM CYLINDER</td>
<td>20-057 ICX</td>
<td>626</td>
<td>SCH</td>
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<tr>
<td>1</td>
<td>FSIC CORE</td>
<td>23-030</td>
<td>626</td>
<td>SCH</td>
</tr>
<tr>
<td>1</td>
<td>SURFACE CLOSER</td>
<td>4040XP SCUSH</td>
<td>689</td>
<td>LCN</td>
</tr>
<tr>
<td>1</td>
<td>KICK PLATE</td>
<td>8400 10&quot; X 2&quot; LDW B-CS</td>
<td>630</td>
<td>IVE</td>
</tr>
<tr>
<td>1</td>
<td>FLOOR STOP</td>
<td>FS18L</td>
<td>BLK</td>
<td>IVE</td>
</tr>
<tr>
<td>1</td>
<td>RAIN DRIP</td>
<td>142AA</td>
<td>AA</td>
<td>ZER</td>
</tr>
<tr>
<td>1</td>
<td>GASKETING (@JAMBS)</td>
<td>328AA</td>
<td>AA</td>
<td>ZER</td>
</tr>
<tr>
<td>1</td>
<td>GASKETING (@HEAD)</td>
<td>429AA</td>
<td>AA</td>
<td>ZER</td>
</tr>
<tr>
<td>1</td>
<td>DOOR SWEEP</td>
<td>39A</td>
<td>A</td>
<td>ZER</td>
</tr>
<tr>
<td>1</td>
<td>THRESHOLD</td>
<td>102A</td>
<td>A</td>
<td>ZER</td>
</tr>
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</table>

-GENERAL CONTRACTOR CONFIRM THRESHOLD TYPE REQUIRED.

HARDWARE GROUP NO. 715A
FOR USE ON DOOR #(S):
101A.2 105A.1 107Y.3 109A.1

PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

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<tr>
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<td>CONT. HINGE</td>
<td>112XY</td>
<td>313AN</td>
<td>IVE</td>
</tr>
<tr>
<td>1</td>
<td>PANIC HARDWARE</td>
<td>35A-NL-OP</td>
<td>313</td>
<td>VON</td>
</tr>
<tr>
<td>1</td>
<td>RIM CYLINDER</td>
<td>20-057 ICX</td>
<td>613</td>
<td>SCH</td>
</tr>
<tr>
<td>1</td>
<td>FSIC CORE</td>
<td>23-030</td>
<td>606</td>
<td>SCH</td>
</tr>
<tr>
<td>1</td>
<td>90 DEG OFFSET PULL</td>
<td>8190HD 10&quot; O</td>
<td>US10B</td>
<td>IVE</td>
</tr>
<tr>
<td>1</td>
<td>SURFACE CLOSER</td>
<td>4040XP SCUSH</td>
<td>695</td>
<td>LCN</td>
</tr>
<tr>
<td>1</td>
<td>FLOOR STOP</td>
<td>FS18L</td>
<td>BLK</td>
<td>IVE</td>
</tr>
<tr>
<td>1</td>
<td>DOOR SWEEP</td>
<td>39D</td>
<td>D</td>
<td>ZER</td>
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<tr>
<td>1</td>
<td>THRESHOLD</td>
<td>102A</td>
<td>A</td>
<td>ZER</td>
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-GENERAL CONTRACTOR VERIFY IN FIELD PRIOR TO BID DATE NEW HARDWARE CAN BE INSTALLED ON EXISTING DOOR/FRAME. NOTIFY ARCHITECT OF INCOMPATIBILITY. IN SUBMITTAL INCLUDE NAME, COMPANY AND DATE OF FIELD VERIFICATION.

-GENERAL CONTRACTOR CONFIRM THRESHOLD TYPE REQUIRED.
HARDWARE GROUP NO. 715W
FOR USE ON DOOR #(S):
102F.1

PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

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<td>98-NL</td>
<td>626</td>
<td>VON</td>
</tr>
<tr>
<td>1</td>
<td>RIM CYLINDER</td>
<td>20-057 ICX</td>
<td>626</td>
<td>SCH</td>
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<td>FSIC CORE</td>
<td>23-030</td>
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<td>SURFACE CLOSER</td>
<td>4040XP SCUSH</td>
<td>689</td>
<td>LCN</td>
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<tr>
<td>1</td>
<td>KICK PLATE</td>
<td>8400 10&quot; X 2&quot; LDW B-CS</td>
<td>630</td>
<td>IVE</td>
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<tr>
<td>1</td>
<td>FLOOR STOP</td>
<td>FS18L</td>
<td>BLK</td>
<td>IVE</td>
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<tr>
<td>1</td>
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<td>142AA</td>
<td>AA</td>
<td>ZER</td>
</tr>
<tr>
<td>1</td>
<td>GASKETING</td>
<td>328AA (@JAMBS)</td>
<td>AA</td>
<td>ZER</td>
</tr>
<tr>
<td>1</td>
<td>GASKETING</td>
<td>429AA (@ HEAD)</td>
<td>AA</td>
<td>ZER</td>
</tr>
<tr>
<td>1</td>
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<td>39A</td>
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<td>THRESHOLD</td>
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<td>ZER</td>
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-GENERAL CONTRACTOR VERIFY IN FIELD PRIOR TO BID DATE NEW HARDWARE CAN BE INSTALLED ON EXISTING DOOR/FRAME. NOTIFY ARCHITECT OF INCOMPATIBILITY. IN SUBMITTAL INCLUDE NAME, COMPANY AND DATE OF FIELD VERIFICATION.

HARDWARE GROUP NO. 805AL
FOR USE ON DOOR #(S):
101V.5 101V.6

PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

<table>
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<tbody>
<tr>
<td>1</td>
<td>CONT. HINGE</td>
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<td>313AN</td>
<td>IVE</td>
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<tr>
<td>1</td>
<td>THUMBTURN CYLINDER</td>
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<td>313</td>
<td>ADA</td>
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<td>DEADBOLT</td>
<td>MS1850S</td>
<td>313</td>
<td>ADA</td>
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<td>MORTISE CYLINDER</td>
<td>20-061 ICX 36-083</td>
<td>613</td>
<td>SCH</td>
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<tr>
<td>1</td>
<td>FSIC CORE</td>
<td>23-030</td>
<td>606</td>
<td>SCH</td>
</tr>
<tr>
<td>1</td>
<td>90 DEG OFFSET PULL</td>
<td>PR8190HD 10&quot; N</td>
<td>US10B</td>
<td>IVE</td>
</tr>
<tr>
<td>1</td>
<td>SURFACE CLOSER</td>
<td>4040XP SCUSH</td>
<td>695</td>
<td>LCN</td>
</tr>
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<td>RAIN DRIP</td>
<td>142D</td>
<td>D</td>
<td>ZER</td>
</tr>
<tr>
<td>1</td>
<td>DOOR SWEEP</td>
<td>39D</td>
<td>D</td>
<td>ZER</td>
</tr>
<tr>
<td>1</td>
<td>THRESHOLD</td>
<td>102A</td>
<td>A</td>
<td>ZER</td>
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-GENERAL CONTRACTOR CONFIRM THRESHOLD TYPE REQUIRED.

HARDWARE GROUP NO. 900BF (BF=BI FOLD)
FOR USE ON DOOR #(S):
105DD

PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

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<th>MFR</th>
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<td>HF4/100A</td>
<td>AL</td>
<td>PEM</td>
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<td>DOOR PULL, 1&quot; ROUND</td>
<td>8103EZHD 10&quot; O</td>
<td>630-</td>
<td>IVE</td>
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Milam County Annex 08 71 00 - 19 Door Hardware Cameron, Texas
HARDWARE GROUP NO. C710  
FOR USE ON DOOR #(S):  
101V.1  101V.2  101V.3  
PROVIDE EACH DOOR(S) WITH THE FOLLOWING:  

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<th>QTY</th>
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<th>FINISH</th>
<th>MFR</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>HINGE</td>
<td>5BB1HW 4.5 X 4.5</td>
<td>652</td>
<td>IVE</td>
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<tr>
<td>2</td>
<td>POWER TRANSFER</td>
<td>EPT10</td>
<td>689</td>
<td>VON</td>
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<tr>
<td>1</td>
<td>ELEC PANIC HARDWARE</td>
<td>RX-QEL-9847-DT-LBR (WDC @ WD)</td>
<td>626</td>
<td>VON</td>
</tr>
<tr>
<td>1</td>
<td>ELEC PANIC HARDWARE</td>
<td>RX-QEL-9847-NL-LBR (WDC @ WD)</td>
<td>626</td>
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HARDWARE GROUP NO. C714A
FOR USE ON DOOR #(#S):
101Q

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HARDWARE GROUP NO. C715
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-GENERAL CONTRACTOR CONFIRM THRESHOLD TYPE REQUIRED.
HARDWARE GROUP NO. C715A  
FOR USE ON DOOR #(#S):  
101A.1 101U  
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HARDWARE GROUP NO. E001  
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-GENERAL CONTRACTOR VERIFY IN FIELD PRIOR TO BID DATE NEW HARDWARE CAN BE INSTALLED ON EXISTING DOOR/FRAME. NOTIFY ARCHITECT OF INCOMPATIBILITY. IN SUBMITTAL INCLUDE NAME, COMPANY AND DATE OF FIELD VERIFICATION.  
-REUSE EXISTING PUSH/PULL.

END OF SECTION
SECTION 08 80 00
GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Glass for the following elements:
      a. Interior and exterior door and window assemblies including transoms and sidelights.

B. Related Sections:
   1. Division 1: Administrative, procedural, and temporary work requirements.
   2. Section 08 11 13 – Hollow Metal Doors and Frames.
   3. Section 08 14 16 – Flush Wood Doors.
   4. Section 08 41 27 – Aluminum Framed Entrances and Storefronts.
   5. Section 08 58 00 – Bullet Resistant Service Windows.
   6. Detailed Door Inventory for glass replacement at existing door assemblies.

1.2 REFERENCES

A. ASTM International (ASTM):
   1. C 864 - Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
   2. C 920 - Elastomeric Joint Sealants.
   3. C 1036 - Flat Glass.
   4. C 1048 - Heat-Treated Flat Glass-Kind HS, Kind FT, Coated and Uncoated Glass.

B. Glass Association of North America (GANA):

1.3 SYSTEM DESCRIPTION

A. Size glass to withstand positive and negative wind pressure acting normal to plane in accordance with Building Code as measured in accordance with ASTM E 330.

B. Limit glass deflection to 1/200 or flexure limit of glass with full recovery of glazing materials, whichever is less.

1.4 SUBMITTALS

A. Product data for each type of glass and accessory items.

B. 12 inch square sample of each type of glass.

C. Samples: Sealant and glazing compound samples showing available colors.
1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Provide tempered safety glass where required by regulatory agencies or Code.


1.6 PROJECT CONDITIONS

A. Perform glazing when ambient temperature is above 40 degrees F.

B. Perform glazing on dry surfaces.

1.7 WARRANTIES

1. Laminated Glass Units: Provide a written 5-year warranty from date of manufacture for laminated glass. Warranty shall cover deterioration due to normal conditions of use and not to handling, installing, and cleaning practices contrary to the glass manufacturer’s published instructions.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Bronze Glass: ASTM C 1036, Type 1 transparent flat, Class 1 clear, Quality q3 glazing select.

B. Bronze Tempered Glass: ASTM C 1048, Type 1 transparent flat, Class 1 clear, Quality q3 glazing select, Kind FT fully tempered.

C. Bullet Resistant Security Glazing: Glass clad polycarbonate complying with UL752 Level 1.

2.2 ACCESSORIES

A. Setting Blocks: ASTM C 864, neoprene or EPDM, or ASTM C 1115, silicone; 80 to 90 Shore A durometer hardness, length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.

B. Spacer Shims: ASTM C 864, neoprene or EPDM, or ASTM C 1115, silicone; 50 to 60 Shore A durometer hardness, minimum 3 inches long x one half the height of the glazing stop x thickness to suit application.

C. Glazing Sealant: ASTM C 920, Type S, Grade NS, Class 25, Uses MT, N, G, and A; single component silicone, low modulus type, non sag, color to be selected from manufacturer’s full color range.

D. Backer Rod and Primer: As recommended by glazing sealant manufacturer.

E. Glazing Clips: Manufacturer’s standard.

F. Glazing Compound: Modified oil type, non hardening, knife grade consistency, color to be selected from manufacturer’s full color range.

2.3 FABRICATION

A. Tempered Glass:

1. Comply with ASTM C 1048 for type listed.
2. Process in horizontal position so that inherent roller distortion will run parallel to building floor lines after installation.

B. Fabrication Tolerances: ASTM C 1036 and C 1048.

C. Glass Identification:
   1. Apply manufacturer’s label indicating type and thickness to each light of glass. Show position of exterior face when installed, where applicable.
   2. Etch manufacturer’s label on each light of tempered glass.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean glazing rabbets; remove loose and foreign matter.

B. Remove protective coatings on metal surfaces.

C. Clean glass just prior to installation.

D. Seal porous rabbet surfaces with primer or sealer.

3.2 INSTALLATION - GENERAL

A. Install glass in accordance with glass manufacturer’s instructions.

B. Maintain manufacturer’s recommended edge and face clearances between glass and frame members.

3.3 PROTECTION & CLEANING

A. After installation, mark glass with an ‘X’ using removable plastic tape.

B. Remove and Replace glass that is broken, chipped, cracked, abraded or damaged in any way, including natural causes, accidents, and vandalism during construction period.

C. Wash glass on both exposed surfaces in each area of project not more than four days before date scheduled for inspections that establish the date of substantial completion. Wash glass as recommended by glass manufacturer.

3.4 SCHEDULE

A. Bronze Glass:
   1. Description: 1/4 inch thick bronze glass, tempered where required.
   2. Locations:
      a. Exterior window and door assemblies including transoms and sidelights.

B. Bullet Resistant Glass:
   1. Description: 3/4” thick clear glass clad polycarbonate.
   2. Locations:
      a. Interior service windows where noted on the window schedule.

C. Plastic Glazing:
   1. Description: ¼” thick clear polycarbonate.
a. Interior service windows where noted on the window schedule.

END OF SECTION
SECTION 09 29 00

GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Gypsum Board.
   2. Cementitious backer units.
   3. Non-load bearing steel framing systems for interior partitions.
   4. Suspension systems for interior ceilings and soffits.
   5. Concealed metal reinforcing for attachment of toilet accessories and other items supported on drywall partitions and walls.
   6. Taping and bedding.

B. Related Sections:
   1. Division 1: Administrative, procedural, and temporary work requirements.
   2. Section 06 10 00 – Rough Carpentry for furring, blocking, and other carpentry work not exposed to view.
   3. Section 07 21 00 – Batt Insulation for acoustical insulation.
   4. Section 07 84 00 – Firestopping at fire rated partitions.
   5. Section 07 92 00 - Joint Sealers.
   6. Section 09 30 13 – Ceramic Tiling.
   7. Section 09 91 00 – Painting and Finishing for priming and painting gypsum drywall.

1.2 REFERENCES

A. American National Standards Institute (ANSI):
   1. A108.11 – Interior Installation of Cementitious Backer Units.
   2. A118.9 – Test Methods and Specifications for Cementitious Backer Units.

B. American Society for Testing and Materials (ASTM):
   1. A 591 – Steel Sheet, Cold Rolled, Electrolytic Zinc-Coated.
   2. A 653A/A 653 M – Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   7. C 754 – Installation of Steel Framing Members to Receive Screw-Attached Gypsum Wall Board, Backing Board, or Water-Resistant Backing Board.

C. Gypsum Association (GA):
   2. GA-216 - Recommended Specifications for the Application and Finishing of Gypsum Board.


1.3 SUBMITTALS

A. Product data for each type of product specified certifying that products comply with specified requirements.

1.4 SYSTEM REQUIREMENTS

A. Performance Requirements: Fabricate and install systems as indicated but not less than that required to comply with ASTM C754 under the following conditions:

1. Gypsum board partitions:
   b. Systems to receive water resistant gypsum board or backer board: Maximum deflection of L/360 of partition height.
   c. If partition height exceeds stud manufacturer’s limiting height for applicable loading and deflection, install bracing above ceiling, decrease stud spacing, or increase stud gage.

2. Interior suspended ceilings: Maximum deflection of L/360 of distance between supports.

B. Fire Resistance Ratings: Where fire resistance classifications are indicated, provide materials and application procedures identical to those listed by UL or tested according to ASTM E119 for type of construction shown.

C. Acoustical Ratings: Where sound ratings are indicated, provide materials and application procedures identical to those tested by manufacturer to achieve Sound Transmission Class (STC) scheduled in accordance with ASTM E90.

1.5 QUALITY ASSURANCE

A. Reference Standards:

1. Applicable requirements of ASTM C754 for installation of steel framing.
2. Install gypsum board in accordance with applicable requirements and recommendations of Gypsum Association GA 216, “Recommended Specifications for the Application and Finishing of Gypsum Board” except for more stringent requirements of manufacturer.
3. Apply acoustical sealant in accordance with applicable requirements of ASTM C919.

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivery:

1. Deliver material to site promptly without undue exposure to weather.
2. Deliver in manufacturer’s unopened containers or bundles, fully identified with name, brand, type and grade.

B. Storage:

1. Store above ground in dry, ventilated space.
2. Protect materials from soiling, rusting and damage.
3. Store board to be directly applied to masonry walls at 70°F for 24 hours prior to installation.

1.7 PROJECT CONDITIONS

A. Environmental Requirements:

1. Do not install gypsum board when ambient temperature is below 40°F.
2. For adhesive attachment of gypsum board, and for finishing of gypsum board, maintain ambient temperature above 55º F from one week prior to attachment or joint treatment, and until joint treatment is complete and dry.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to the following:
   1. Georgia-Pacific Corp.
   3. United States Gypsum Co.

2.2 PANEL PRODUCTS

A. Regular Gypsum Board: ASTM C1396; 48 inches wide x thickness indicated, or if not indicated, in 5/8 inch thickness, maximum practical length, tapered edge; apply to non-rated wall and ceiling assemblies.
   1. Product: SHEETROCK® brand SW as manufactured by USG or approved equal.

B. Fire Resistant Gypsum Board:
   1. Type X: ASTM C36, 48 inches wide x thickness indicated, or if not indicated, in 5/8 inch thickness, maximum practical length, tapered edge; apply to fire rated wall and ceiling assemblies.
   2. Product: FIRECODE® or FIRECODE® “C” Core gypsum panels as manufactured by USG or approved equal.

C. Cementitious Backer Units: ANSI A 118.9, high density, cementitious with glass fiber reinforcing, nominally 5/8 inch thick x 48 inches wide, maximum practical length, ends and edges square cut; apply to wall to receive ceramic tile.
   1. Product: Durock Cement Board as manufactured by USG or approved equal.

2.3 METAL FRAMING AND FURRING MATERIALS

A. General:
   1. Provide components in accordance with ASTM C645.
   2. Finish: G40 hot-dipped galvanized coating per ASTM A525.

B. Metal Floor and Ceiling Runners
   1. Channel Type: Formed from 20 gauge (unless otherwise noted) galvanized steel, width to suit channel type metal studs. Use 20 gauge top runners with 1-1/4” minimum flanges.
   2. Ceiling runners at fire rated partitions shall be “Fire Trak” made by the Fire Trak Corp. fabricated of 20 gauge galvanized steel.

C. Metal Studs, Framing and Furring
   1. Channel Type Studs: Channel type with holes for passage of conduit formed from minimum 20 gauge (unless heavier gauge required to meet deflection limits) galvanized steel, width as shown on drawings.
   2. Furring Channels: 7/8” - inch hat shaped channel formed from minimum 20 gauge galvanized steel.
3. Resilient Furring Channels: Manufacturer’s standard type designed to reduce sound transmission; ½-inch deep, 25 gauge core steel.

4. Continuous 16 gauge x 8” wide steel wall plate screwed to studs as required for support of railings, toilet partitions and other items supported on drywall partitions and walls.

2.4 CEILING AND SOFFIT SUPPORT MATERIALS

A. Hanger Anchorage Devices: Screws, clips, bolts or other devices compatible with indicated structural anchorage for ceiling hangers and whose suitability has been proven through standard construction practices or y certified test data.

B. Hangers:
   1. Steel wire or rods, sizes to comply with requirements of ASTM C754 for ceilings or soffit area and loads to be supported.
   2. Wire: ASTM A641, soft, Class 1 galvanized, minimum 8 gauge.

C. Rods and flats:
   1. Mild steel components.
   2. Finish: Galvanized with G40 hot-dipped galvanized coating per ASTM A525.

D. Framing System:
   1. Main runners:
      a. Cold-rolled, “C” shaped steel channels, 16 gauge minimum.
      b. Finish: Galvanized with G40 hot-dipped galvanized coating per ASTM A525.
   3. Furring anchorages: 16 gauge galvanized wire ties, manufacturer’s standard wire-type clips, bolts, nails or screws recommended by furring manufacturer and complying with ASTM C754.

2.5 ACCESSORIES

A. Fasteners:
   1. For attaching framing to concrete and wood framing: Type best suited to application.
   2. For fastening framing members together: 3/8 inch long pan head screws.
   3. For attaching gypsum panels to framing: ASTM C 1002, Type S screws, minimum 5/8 inch penetration into framing.

B. Wire: Galvanized steel.
   1. Hanger wire: 8 gage.
   2. Tie wire: 18 gage, soft annealed

C. Metal Accessories: Galvanized steel unless otherwise indicated.
   1. Metal corner reinforcement: GA-216, Type CB-100x100.
   2. Metal casings: GA-216, Type LC.
   4. Metal furring channel clips.

D. Acoustical Sealer: Non-hardening, non-skining, acoustical sealer designed for used with gypsum board.

E. Joint Treatment Materials: Reinforcing tape and joint compound; ASTM C475.
PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install in accordance with reference standards and manufacturer's instructions.

B. Tolerances:
   1. Do not exceed 1/8 inch in 8'-0" variation from plumb or level in exposed lines of surface, except at joints between gypsum board units.
   2. Do not exceed 1/16 inch variation between planes of abutting edges or ends.
   3. Shim as required to comply with specified tolerances.

C. Install framing to comply with ASTM C754 and with ASTM C840 requirements that apply to framing installation.

D. Install supplementary framing, blocking and bracing at terminations in gypsum board assemblies to support fixtures, equipment, heavy trim, grab bars, toilet accessories, furnishings or similar construction.

3.2 INSTALLATION OF CEILING FRAMING

A. Install in accordance with ASTM C 754 and manufacturer's instructions.

B. Space hanger wires 48 inches on center along runner channels and within 6 inches of ends of channels; secure to structure above.

C. Space runner channels 48 inches on center maximum and within 6 inches of abutting construction.

D. Position channels for ceiling height; level and saddle tie along channels.

E. Provide 1 inch clearance between channels and abutting construction.

F. Overlap channel ends 12 inches at splices; secure each end with double loop tie wire.

G. Space furring channels 16 inches on center maximum, perpendicular to runners and within 6 inches of abutting construction.

H. Provide 1 inch clearance between channels and abutting construction.

I. Secure to runners with clips on alternate sides of runners; saddle tie if clips cannot be alternated.

J. Overlap channel ends 8 inches at splices; secure each end with double loop tie wire.

K. Where openings interrupt furring or runner channels, install reinforcing to restore stability.

3.3 INSTALLATION OF GYPSUM PANELS

A. Install panels and accessories in accordance with ASTM C 754, GA-216, and manufacturer's instructions.

B. Accurately cut panels to fit around openings and projections. Do not tear face paper or break gypsum core.

C. Place fasteners minimum 3/8 inch from edges of panels; drive heads slightly below surface. Stagger fasteners at abutting edges.
D. Wall Panels:
1. Apply panels at non fire-rated assemblies in most economical manner, with ends and edges occurring over supports.
2. Apply panels at fire-rated assemblies as required by design assembly.
3. Stagger joints on opposite sides of partitions.
4. Do not locate joints to align with edges of openings unless a control joint is installed.
5. Mechanically fasten single layer panels to framing.
6. Apply face layer of double layer applications with joints offset from those in base layer; secure with mechanical fasteners to framing or with adhesive to base layer.
7. At slip head connections, cut panels 1/2 inch short of structure at head; do not secure panels to top runner channel.
8. Where recessed items occur in fire rated partitions, box item on all sides with gypsum board as required to maintain continuity of fire rating.

E. Ceiling Panels:
1. Apply panels perpendicular to framing, with end joints staggered.
2. Support panels around openings in ceiling.
3. Mechanically fasten to framing.

3.4 INSTALLATION OF ACOUSTICAL PARTITIONS

A. Extend acoustical partitions past intersecting non-acoustical partitions.

B. Install acoustical insulation:
1. Butt to framing members and adjacent construction.
2. Carry around pipes, wiring, outlets, and other construction without voids.
3. Press against one gypsum board surface to form slight air space on opposite side.

C. Seal acoustical partitions at perimeter and around penetrations:
1. Apply continuous bead of sealer between gypsum panel edges and adjacent construction. In double layer applications, apply to base layer.
2. Seal space between gypsum panels at control joints, prior to installing metal control joint.
3. Apply sealer to penetrations through partitions.
4. In fire rated partitions, use firestopping sealer specified in Section 07840. In non-fire rated partitions, use acoustical sealer.

3.5 INSTALLATION OF CEMENTITIOUS BACKER UNITS

A. Install in accordance with ANSI A108.11 and manufacturer's instructions.

B. Apply panels horizontally, with ends occurring supports. Stagger end joints in adjacent rows.

C. Cut panels to fit around openings and projections.

D. Mechanically fasten panels to framing.

3.6 INSTALLATION OF ACCESSORIES

A. Install in accordance with manufacturer's instructions.

B. Install corner reinforcement at outside corners. Use single lengths where length of corner does not exceed standard length.
C. Install casings where indicated and where gypsum board abuts dissimilar materials or stops with edge exposed.

D. Install control joints at ceilings:
   1. At maximum 50 feet on center.
   2. Where ceiling framing changes direction.

E. Install control joints at walls and partitions:
   1. At changes in backup material.
   2. At maximum 30 feet on center.
   3. Above one jamb of openings in partitions.

3.7 JOINT TREATMENT
   A. Treat joints and fasteners in gypsum board in accordance with GA-214.
   B. Levels of Finish:
      1. Surfaces in plenums and janitor closets: Level 1 finish.
      2. Surfaces to receive paints and wall coverings: Level 4 finish.

3.8 CLEANING AND PROTECTION
   A. Promptly remove any residual joint compound from adjacent surfaces.
   B. Provide final protection and maintain conditions in a manner suitable to Installer that ensures gypsum board assemblies remain without damage or deterioration at time of Substantial Completion.

END OF SECTION
SECTION 09 30 13
CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Ceramic wall and floor tiles in all restrooms where indicated on the Drawings.
   2. Stone thresholds.
   3. Trim and accessories.
   4. Sealing existing quarry tile and new tile finishes throughout.

B. Related Sections:
   1. Division 1: Administrative, procedural, and temporary work requirements.
   2. Section 07 92 00 - Joint Sealants.
   3. Section 09 29 00 – Gypsum Board Assemblies for cementitious backer units.
   4. Section 10 28 00 – Toilet and Bath Accessories.

1.2 REFERENCES

A. American National Standards Institute (ANSI):

B. American Society for Testing and Materials (ASTM):
   4. C 1028 – Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.

C. Tile Council of America (TCA) - Handbook for Ceramic Tile Installation.

1.3 SUBMITTALS

A. Product Data: Manufacturer's installation, cleaning, and maintenance instructions for each type of product indicated.

B. Samples:
   1. Tile: Full size sample of each type of tile for approval of color and profile.
   2. Grout: Cured samples showing available colors.
   3. Marble thresholds.

1.4 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Installer is a five-star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors’ Association of America.
   2. Minimum 5 years experience in Work of this Section.
3. Successful completion of at least 3 projects of similar scope and complexity within past 5 years.

B. Mock-ups: Prior to the start of tile work build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build 3’x3’ mockup of each type of floor tile installation.
   2. Build 3’x3’ mock-up of each type of wall tile installation, include base tile, field tile, and cap tile.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Tile and Trim Units: Meet ANSI A137.1, Standard Grade.

D. Static Coefficient of Friction for Floor Tile: Minimum 0.60, tested to ASTM C 1028 in dry condition.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver all products to job site in manufacture's unopened containers with grade seals unbroken and labels intact.

B. Keep tile cartons dry.

C. Deliver adhesive and grout containers bearing hallmark certifying compliance with reference standards.

D. Protect adhesive containers from freezing and overheating according to manufacturer's instructions.

1.6 PROJECT CONDITIONS

A. Environmental Requirements: Maintain minimum ambient temperature of 50 degrees F during and after installation.

1.7 EXTRA STOCK

A. Extra Stock: Provide to the Owner 2 percent of each color and type of tile matching products installed. Package for storage with labels clearly describing contents.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide Standard-grade tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

2.2 MANUFACTURERS

A. Acceptable Manufacturers - Ceramic Tile:
   1. American Olean Tile Co., Inc.
   2. Dal-Tile Corp.

2.3 TILE PRODUCTS

A. Ceramic Wall Tile:
1. Source: American Olean Bright and Matte Group 1 Wall Tile.
2. Edge: Cushioned.
3. Field tile, all restrooms:
   a. Size: 4 1/4 inches wide x 4 1/4 inches high x 5/16 inch thick.
   b. Color: White (0090).
4. Accent tile:
   a. Wall bullnose cap:
      (1) Size: 4 1/4 inches wide x 4 1/4 inches high x 5/16 inch thick, # S-4449.
      (2) Color: Marshmallow (0065) for Women's; Light Smoke (0042) for Men's & Unisex
   b. Cove base:
      (1) Size: 4 1/4 inches wide x 4 1/4 inches high x 5/16 inch thick, # A-3401.
      (2) Color: Marshmallow (0065) for Women's; Light Smoke (0042) for Men's & Unisex
5. Trim units:
   a. Furnish inside and outside corners as required.
   b. Color to match field or accent tile.

B. Unglazed Ceramic Mosaic Floor Tile:
2. Field tile, all restrooms:
   a. Size: 2x2 Mosaic.
   b. Color: Marshmallow A65 in Women's and Storm Gray A22 in Men's & Unisex.

2.4 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
   1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/14 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to ½ inch or less above adjacent floor surface.

   1. Provide: Crema Marfil Classico M722 in Women’s, Carrara M701 in men’s and Unisex, as manuf. By American Olean.

2.5 SETTING AND GROUTING MATERIALS

B. Mortar Materials:
   1. Portland Cement: ASTM C150, Type 1, white color.

B. Portland Cement Mortar (Thickset) Installation Materials for tile flooring: Mortar bed, 1 ¼” – 2” thick, reinforcing, and cleavage membrane complying with ANSI A108.02.
   1. Cleavage Membrane: 6 mil black polyethylene film or No. 15 asphalt saturated felt.
   3. Reinforcing: 2x2 inch, 16/16 gage welded wire mesh, hot dip galvanized.

C. Dry Set Mortar (Thinset) Installation Materials for wall tile:
   1. Standard Dry-set mortar: ANSI A118.1
a. Product: LATICRETE 272 Mortar, as manufactured by LATICRETE International, Inc., or approved equal.
b. For wall applications, provide nonsagging mortar.

2. Modified Latex-Portland cement mortar: ANSI A118.4
c. Product: LATICRETE Mega Bond Kit, as manufactured by LATICRETE International, Inc., or approved equal.

D. Grout: ANSI A118.6 (Standard Cement Grout) or 118.7 (High-Performance Tile Grout).
   1. Product: PERMACOLOR® Select, as manufactured by LATICRETE International, Inc., or approved equal.

2.6 ACCESSORIES

A. Tile Cleaner: Proprietary blend of inhibited, mild acids, compatible with tile and setting materials.
   1. Product: Standoff Grout & Tile Cleaner, as manufactured by PROSOCO, Inc., 3741 Greenway Circle, Lawrence, KS 66046. Phone: (800) 255-4255; Fax: (785) 830-9797.

B. Tile Sealer for Quarry Tile and Unglazed Porcelain Tile: Solvent based penetrating sealer.
   1. Product: UltraCare Penetrating SB Stone, Tile, & Grout Sealer as manufactured by Mapei. Note not for use on glazed tile.

C. Water: Clean, potable.

D. Joint Sealers: Specified in Section 07 92 00.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with [adhesives] [bonded mortar bed] [or] [thinset mortar] with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.
3.3 CERAMIC TILE INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

   1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
      a. Tile floors in wet areas.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Where accent tile differs in thickness from field tile, vary setting bed thickness so that tiles are flush.

F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:


H. Lay out tile wainscots to next full tile beyond dimensions indicated.

I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

J. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

K. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.

   1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, thinset thresholds.
   2. Do not extend cleavage membrane or waterproofing under thinset thresholds. Fill joints between such thresholds and adjoining tile set on cleavage membrane or waterproofing with elastomeric sealant.

L. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.

3.4 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor: TCNA F111-11; Reinforced cement mortar bed (thickset) with cleavage membrane.
B. Interior Wall Installations, Wood or Metal Studs or Furring: TCNA W244F-11; Thinset mortar on cementitious fiber-cement backer board.

3.5 ADJUSTING
A. Remove and replace pieces that have been damaged during installation.

3.6 PROTECTION
A. Provide protection for completed work using non-staining sheet coverings.
B. Prohibit traffic on tile floors for minimum 3 days after installation.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY
A. Section includes acoustical tiles and concealed suspension systems for ceilings.

1.2 ACTION SUBMITTALS
A. Product Data: For each type of product.
B. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS
A. Product test reports.
B. Evaluation reports.

1.4 CLOSEOUT SUBMITTALS
A. Maintenance data.

1.5 QUALITY ASSURANCE
A. Testing Agency Qualifications: Qualified according to NVLAP.
B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockup of typical ceiling area as shown on Drawings.
   2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACOUSTICAL TILE CEILINGS, GENERAL
A. Acoustical Tile Standard: Comply with ASTM E 1264.
B. Metal Suspension System Standard: Comply with ASTM C 635.
C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
D. Wire Hangers, Braces, and Ties: Zinc-coated carbon-steel wire; ASTM A641/A641M, Class 1 zinc coating, soft temper.

2.2 ACOUSTICAL TILES
   A. Product: Mars ClimaPlus mineral fiber acoustic ceiling tile manufactured by USG Interiors, LLC.
   B. Classification: Type IV, Form 1 and 2, Pattern E, G.
   C. Color: White.
   D. LR: .90.
   E. NRC: .75, Type E-400 mounting according to ASTM E 795.
   F. CAC: 35.
   G. Size: 24-inch square and 24-inch by 48-inch as indicated on the Drawings.
   H. Edge/Joint Detail: Square.
   I. Thickness: ¾-inch.

2.3 METAL SUSPENSION SYSTEM
   A. Product: DX/DXL exposed suspension system as manufactured by USG Interiors, LLC.
   B. Structural Classification: Intermediate-duty system.
   C. Color: Flat white.
   D. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Manufacturer's standard moldings for edges and penetrations complying with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

PART 3 - EXECUTION

3.1 INSTALLATION
   A. Install acoustical tile ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
   B. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders, and comply with layout shown on reflected ceiling plans.
   C. Arrange directionally patterned acoustical tiles as indicated on reflected ceiling plans.

END OF SECTION
SECTION 09 65 19
RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Vinyl composition tile flooring in Breakrooms and elsewhere where indicated on the Drawings.
B. Rubber base.
C. Edging strips.
D. Underlayment and floor patch.
E. Adhesives and primers.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM E84 Test Method for Surface Burning Characteristics of Building Materials
   3. ASTM E662 Test Method for Specific Optical Density of Smoke Generated by Solid Materials
   4. ASTM F 710: Practice for Preparing Concrete Floors and other Monolithic Floors to Receive Resilient Flooring.
   6. ASTM F 1700: Specification for Solid Vinyl Floor Tile
   8. ASTM F 2034 for Linoleum Sheet Flooring.
B. Federal Specifications (FS):
   1. SS-T-312 Tile, Floor: Asphalt, Rubber, Vinyl, Vinyl-Asbestos
C. Resilient Floor Covering Institute (RFCI):
   1. RFCI Installation Specifications

1.3 SUBMITTALS

A. Product Data: Submit manufacturer’s technical data, installation and maintenance instructions for flooring and accessories including leveling compound, and adhesive.
B. Samples:
   1. Two 6-inch x 6-inch samples of each resilient floor product indicated in color(s) specified.
   2. Two 6-inch x full height samples of rubber base in color(s) specified.
   3. Each type of edge or transition strip.
C. Color Charts: Submit resilient tile selections showing full range of colors and patterns available.
1.4 QUALITY ASSURANCE

A. Installer Qualifications: Firm with minimum five years successful experience completing resilient tile installation similar to that required for this project.

B. Field Mock-up: Provide mock-up of vinyl composition tile installation using approved materials and specified methods of installation, minimum 4 feet by 4 feet.
   1. Obtain Architect’s acceptance of mock-ups prior to start of resilient tile installation.
   2. Approved mock-up may be incorporated into Project.

1.5 PROJECT CONDITIONS

A. Maintain minimum 65 degree F air temperature at flooring installation area for minimum two days prior to, during, and for minimum 24 hours after installation of resilient tile.

B. Store flooring materials in area of application; allow two days for material to reach same temperature as area.

C. Maintain the ambient relative humidity between 40% and 60% during installation.

D. Maintain minimum temperature of 55 degrees F after flooring is installed except as otherwise specified.

E. Close spaces to traffic during floor covering installation.

F. Close spaces to traffic for 48 hours after floor covering installation.

G. Install resilient products after other finishing operations, including painting, have been completed.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Floor Tile: Furnish full size tiles required for project equal to 5% of the amount install for each type and color.

1.7 WARRANTY

A. Provide manufacturer’s warranty guaranteeing that commercial homogeneous tile will be free of manufacturing defects for a period of Five years from the date of Substantial Completion. Manufacturer’s warranty is in addition to, and not a limitation of other rights the Owner may have under construction documents.

PART 2 – PRODUCTS

2.01 VINYL COMPOSITION FLOOR TILE

A. Vinyl Composition Floor Tile: ASTM F1066, Class 2, Through Pattern, 0.125-inch thick, Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm per ASTM E 648.
   1. Size: 12-inch x 12-inch.
   2. Thickness: 1/8-inch.

B. Product: Premium Excelon ChromaSpin as manufactured by Armstrong Flooring
   1. Color: TBD
2.2 RUBBER BASE

A. Rubber Base: ASTM F 1861, Type TP (rubber, thermoplastic).
   2. Style and Location: Cove, provide in locations where indicated on the Drawings.
   4. Height: 4-inches.
   5. Lengths: Coils in manufacturer’s standard length.
   6. Outside and Inside Corners: Job formed.

B. Product: Burke Resilient Rubber Wall Base as manufactured by Burke Flooring.
   1. Colors: Selected from manufacturer’s standard colors.
      a. Base 1: TBD
      b. Base 2: TBD

2.3 RUBBER MOLDING ACCESSORY

A. Description: Rubber reducer strip for resilient flooring, joiner for tile and carpet, and transition strips.

B. Profile and Dimensions: Provide in profiles and dimensions to suit thickness of flooring materials.

C. Locations: Provide at locations where there is a change in flooring material.

D. Colors: Provide in colors to closely match flooring materials

2.4 INSTALLATION MATERIALS

A. Subfloor Filler: Hydraulic/Portland cement based material designed for providing thin solid surface for leveling and for minor ramping of subsurface to adjacent floor finishes.

B. Primer and Adhesives: Water and alkali resistant, zero regulated VOV types as recommended by flooring manufacturer for specific application.

2.5 SOURCE QUALITY

A. Source Quality: Obtain flooring product material from a single manufacturer for each type of material specified.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify conditions of substrate are suitable for installation of resilient tile in accordance with manufacturer recommendations.
   1. Concrete to comply with ASTM F 710, to be free of materials which could interfere with adhesion of resilient tile, to be tested using the qualitative calcium chloride test as detailed under ASTM F 1869 with results of 3 lbs. or less of vapor transmission (MVER), surface alkali of 9 or less as measured by pH test paper, and free of carbonization and dust.
   2. Wood underlayment to have a smooth fully sanded face, free of irregularities, and to be free of substances which could interfere with adhesion of resilient tile.

3.2 PREPARATION

A. Comply with manufacturer recommendations for preparation of substrate.
1. Concrete: Comply with ASTM F 710 in addition to manufacturer recommendations for preparation of substrate.
2. Remove subfloor ridges and bumps; fill low spots, cracks, joints, holes, and defects with subfloor filler.
3. Clean floor and apply, trowel, and float filler to leave smooth, flat hard surface.
   a. Prohibit traffic in area until filler is cured.

3.3 RESILENT TILE INSTALLATION

A. Installation Standards: Comply with RFCI Installation Specifications and Manufacturer’s recommendations and installation instructions.
B. Open floor tile cartons, enough to cover each area, and mix tile to ensure shade variations do not occur within any one area.
C. Clean substrate.
D. Spread cement evenly in quantity recommended by manufacturer to ensure adhesion over entire area of installation; spread only enough adhesive to permit installation of flooring before initial set.
E. Set flooring in place, press with heavy roller to ensure full adhesion.
F. Lay flooring with joints parallel to building lines to produce symmetrical pattern.
G. Install minimum ½ tile at room and area perimeter.
H. Install edge strips at unprotected and exposed edges where flooring terminates.
I. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, door frames, and thresholds.
J. Refer to drawings for floor pattern in each area.

3.4 RESILENT BASE INSTALLATION

A. Comply with manufacturer’s written instructions for installing resilient base.
B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
E. Do not stretch resilient base during installation.
F. Retain first paragraph below if required or revise to suit Project.
G. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
H. Retain "Job-Formed Corners" Paragraph below for resilient base with job-formed corners.
I. Job-Formed Corners:
1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
   a. Form without producing discoloration (whitening) at bends.
2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
   a. Miter or cope corners to minimize open joints.

3.5 RESILIENT ACCESSORY INSTALLATION

   A. Comply with Manufacturer's written instructions for installing resilient accessories.

   B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

3.6 CLEANING

   A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove construction debris from project site and legally dispose of debris.

   1. Remove visible adhesive and other surface blemishes using cleaning methods recommended by tile floor manufacturer.
   2. Sweep and vacuum floor after installation.
   3. Do not wash floor until after time period recommended by tile flooring manufacturer.
   4. Damp-mop tile flooring to remove black marks and soil.

3.7 PROTECTION

   A. Provide protection for completed work.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY
   A. Section includes modular carpet tile in the Milam County Annex where indicated on the Drawings.

1.2 ACTION SUBMITTALS
   A. Product Data: For each type of product.
   B. Shop Drawings: For carpet tile installation, plans showing the following:
      1. Type, color, and location of insets and borders.
      2. Transition details to other flooring materials.
   C. Samples: For each exposed product and for each color and texture required.

1.3 INFORMATIONAL SUBMITTALS
   A. Product test reports.
   B. Sample warranty.

1.4 CLOSEOUT SUBMITTALS
   A. Maintenance data.

1.5 QUALITY ASSURANCE
   A. Installer Qualifications: Certified by the International Certified Floorcovering Installers Association at the Commercial certification level.

1.6 WARRANTY
   A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
      1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS - CARPET TILE
   A. Manufacturers: Subject to compliance with requirements, provide products by the following:
2.2 CARPET TILE

A. Type: Carpet Tile 1
   1. Collection: TBD from the following collection: Platform Main Line & Sidetrack
   2. Product Number: TBD
   3. Color: TBD
   4. Size: 19.69 inches x 19.69 inches

B. Type: Carpet Tile 2
   1. Collection: TBD from the following collection: Platform Main Line & Sidetrack
   2. Product Number: TBD
   3. Color: TBD
   4. Size: 19.69 inches x 19.69 inches

C. Performance Requirements
   1. Flooring Radiant Panel: (ASTM E-648) Class 1
   2. Smoke Density: (ASTM E-662) ≤ 450
   3. Flammability: Passes Methenamine Pill Test (DOC-FF1-70)
   4. Lightfastness: (AATCC 16 – E) ≥ 4.0 @ 60 AFU's
   5. Static: (AATCC – 134) < 3.0 KV
   6. Dimensional Stability: AACHEN Din 54318 < 10%
   7. Traffic Classification: Heavy
   8. Fiber Modification Ratio: 1.7 to 1.9

D. Backing System: **GlasBac**.

E. Applied Treatments:
   1. Soil / Stain Treatment: Protekt
   2. Antimicrobial Treatment: Intersept, that protects carpet tiles as follows:
      a. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.

2.3 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.
   1. **TacTile connectors**.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Concrete Slabs:
1. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft. (304.8 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
   a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of [3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m)] <Insert emission> in 24 hours.
   b. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

3.2 PREPARATION

A. General: Comply with CRI's "CRI Carpet Installation Standards" and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider, and protrusions more than 1/32 inch (0.8 mm) unless more stringent requirements are required by manufacturer's written instructions.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI's "CRI Carpet Installation Standard," Section 18, "Modular Carpet" and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer. Peel-and-stick adhesive.

C. Maintain dye-lot integrity. Do not mix dye lots in same area.

D. Maintain pile-direction patterns [indicated on Drawings] [recommended in writing by carpet tile manufacturer].

E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders.

I. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION
SECTION 09 91 00
PAINTING AND FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Surface preparation and field application of paints, stains, and sealers.

B. Related Sections:
   1. Division 1: Administrative, procedural, and temporary work requirements.
   2. Section 05 55 00 – Metal Fabrications.
   3. Section 06 46 00 – Wood Trim.
   4. Section 08 11 13 – Hollow Metal Doors and Frames.
   5. Section 08 31 13 – Access Doors and Frames.
   6. Section 08 36 13 – Overhead Doors.
   7. Section 09 29 00 – Gypsum Board Assemblies.

1.2 REFERENCES


B. Society for Protective Coatings (SSPC) - Painting Manual.

1.3 SUBMITTALS

A. Product Data: Manufacturer's data on materials proposed for use. Include:
   1. Product designation and grade of each coating type.
   2. Surface preparation materials and procedures.
   3. Product analysis and performance characteristics for each coating type.

B. Samples:
   1. 3 x 6 inch samples of each of the selected colors and glosses applied on representative substrates on which the coating will be applied in the Work. Apply each coat stepped back 1 inch so that all coats remain exposed. Indicate type of material used for each coat.

C. Paint Schedule: Detailed schedule indicating type and location of surface, coating materials, and number of coats to be applied.

1.4 QUALITY ASSURANCE

A. Paint Applicator Qualification: Engage an experienced applicator who has completed paint system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.

B. Provide finish coats which are compatible with prime paints used.
C. **Mockups:**
   1. Construct substrate preparation and paint application mockup panels, 4 feet wide x full height, for each color and substrate to be painted in the project, illustrating each coating color and finish.
   2. Locate where directed by Architect.
   3. Approved mockups may remain as part of Work.

1.5 **DELIVERY, STORAGE AND HANDLING**

A. Deliver paints, coatings, solvents and similar materials to the job site in their original unopened containers with seals unbroken, labels intact and legible at time of use and with the manufacturer’s instructions printed thereon. Do not use expired materials. Remove and do not store expired materials on-site.

B. Paint Materials: Store at minimum ambient temperature of 45 degrees F and maximum of 90 degrees F, in ventilated area, or as required by manufacturer’s instructions.

1.6 **PROJECT CONDITIONS**

A. Do not apply materials when surface and ambient temperatures or relative humidity are outside ranges required by manufacturer.

B. Provide lighting level of 80 footcandles measured mid-height at substrate surface.

1.7 **MAINTENANCE**

A. Extra Stock: Deliver to the Owner an extra stock of paint equaling one gallon of each color and gloss used in each finish coating material. Extra stock shall be tightly sealed in clearly labeled containers.

**PART 2 - PRODUCTS**

2.1 **MANUFACTURERS**

A. Contract Documents are based on products by Sherwin Williams Co. unless otherwise noted.

B. Equivalent products by the following manufacturers are acceptable:
   1. Benjamin Moore and Co. (www.benjaminmoore.com)
   2. Devoe Paint Co. (www.devoepaint.com)
   6. PPG Architectural Finishes, Inc. (www.pittsburghpaints.com)
   7. Pratt and Lambert Paints. (www.prattandlambert.com)
   8. Tnemec


2.2 **PAINT MATERIALS**

A. **Prime Coats:** Provide undercoat paint produced by the same manufacturer as the finish coats. Use only thinners approved by the paint manufacturer, and use only to manufacturer-recommended limits. Two prime coats may be required to provide a proper base for finish coats.
B. Colors and Glosses: Colors and glosses shall be as selected by the Architect. Colors will require paint manufacturer to prepare special factory mixes to match colors selected by the Architect. Color schedule (with gloss) shall be furnished by the Architect. The Architect and the Owner reserve the right to change custom colors and glosses, without additional cost to the Owner.

C. Coloring Pigment: Products of or furnished by the manufacturer of the paint or enamel approved for the work.

D. Linseed Oil: Raw or boiled, as required, of approved manufacture, per ASTM D234 and D260, respectively.


F. Dryers, Putty, Spackling Compound, Patching Plaster, etc.: Best quality, of approved manufacture.

G. Solvents: Submit solvents recommended by paint manufacturers for each substrate condition.

2.3 MIXING

A. Colors: Architect will furnish color schedule prior to commencement of painting.

B. Uniformly mix to thoroughly disperse pigments.

C. Do not thin in excess of manufacturer’s recommendations.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Test shop applied primer for compatibility with subsequent coatings.

B. Measure moisture content of surfaces using electronic moisture meter. Do not apply coatings unless moisture content of surfaces are below following maximums:
   1. Concrete: 5 percent.
   2. Wood: 15 percent, measured to ASTM D 4442.

3.2 PREPARATION

A. General:
   1. Protect adjacent and underlying surfaces.
   2. Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
   3. Correct defects and clean surfaces capable of affecting work of this section.
   4. Seal marks that may bleed through surface finishes with shellac.

B. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow to dry.

C. Concrete:
   1. Clean surfaces of loose and foreign matter that could affect penetration or performance of sealer; follow manufacturer’s instructions.
   2. Thoroughly rinse surfaces with clean water.
   3. Allow surfaces to dry completely before beginning application.
D. Galvanized Steel: Remove surface contamination and oils and wash with solvent.

E. Uncoated Ferrous Metals:
   1. Remove grease, mill scale, weld splatter, dirt, and rust.
   2. Where heavy coatings of scale are evident, remove by hand or power tool wire brushing or sandblasting; wash with solvent.
   3. Apply treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned.
   4. Spot prime paint after repairs.

F. Shop Primed Ferrous Metals:
   1. Sand and scrape to remove loose primer and rust. Feather edges to make patches inconspicuous.
   2. Clean with solvent.
   3. Prime bare steel surfaces.

G. Interior Wood for Transparent Finish:
   1. Wipe off dust and grit prior to sealing.
   2. Seal knots, pitch streaks, and sappy sections with sealer.
   3. Fill nail holes and cracks after sealer has dried; sand lightly between coats.

H. Metal Doors: Prime door top and bottom edge surfaces.

3.3 PAINT APPLICATION

A. Apply primer or first coat immediately after surface preparation is complete to prevent recontamination.

B. Do not apply finishes to surfaces that are not dry.

C. Apply coatings to minimum dry film thickness recommended by manufacturer.

D. Apply each coat of paint slightly darker than preceding coat unless specified otherwise.

E. Apply coatings to uniform appearance without laps, sags, curtains, holidays, and brush marks.

F. Allow applied coats to dry before next coat is applied.

G. Sand between coats on interior wood and metal surfaces.

H. Match final coat to approved color samples.

I. Where clear finishes are specified, tint fillers to match wood. Work fillers into grain before set. Wipe excess from surface.

J. Prime concealed surfaces of interior wood in contact with masonry or cementitious materials with one coat primer paint.

K. Mechanical and Electrical Components:
   1. Paint factory primed equipment.
   2. Remove unfinished and primed louvers, grilles, covers, and access panels; paint separately.
   3. Paint exposed and insulated pipes, conduit, boxes, ducts, hangers, brackets, collars, and supports unless factory finished.
4. Do not paint name tags or identifying markings.
5. Paint exposed conduit, electrical equipment and raceway in finished areas.

L. Do not Paint:
1. Surfaces indicated on Drawings or specified to be unpainted or unfinished.
2. Surfaces with factory applied finish coat or integral finish, except for touching-up of damaged surfaces.
3. Masonry surfaces.
4. Finish hardware.
5. Architectural metals, including brass, bronze, stainless steel, and chrome plating.
6. Surfaces not to be painted shall be left completely free of droppings and accidentally applied materials resulting from the Work of this Section

3.4 FIELD QUALITY CONTROL
A. Manufacturer’s Field Services: Ensure that materials are being applied properly.

3.5 ADJUSTING
A. Make detailed inspection of paint work; touch up abraded, stained, and otherwise disfigured surfaces or refinish as required.

3.6 CLEANING
A. Remove paint from adjacent surfaces.

3.7 PAINT SCHEDULE
A. Types of paint listed herein are set forth as standard of quality and type of coating required for each type of surface.
   1. Exposed surfaces of type listed in following schedule are to be painted.
   2. Other exposed surfaces not specifically listed shall receive not less than two coats of appropriate type of coating.

B. Prime coat shall consist of touch up only on shop primed and existing surfaces.

<table>
<thead>
<tr>
<th>SUBSTRATE</th>
<th>PRIMER</th>
<th>TOP COATS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exterior Surfaces:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ferrous &amp; Galvanized metals</td>
<td>None</td>
<td>Two coats DTM Acrylic Semi-gloss Coating</td>
</tr>
<tr>
<td>(finished, hollow metal doors &amp;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>frames, railings)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Galvanized metals (unfinished,</td>
<td>ZRC Galviline Galvanizing Repair</td>
<td></td>
</tr>
<tr>
<td>for touch-up)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cast Stone Panels</td>
<td>Loxon Concrete &amp; Masonry Primer/Sealer</td>
<td>Conflex XL Smooth Elastomeric High Build Coating</td>
</tr>
<tr>
<td></td>
<td>Interior/Exterior Latex</td>
<td></td>
</tr>
<tr>
<td>Interior Surfaces:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gypsum board, flat finish</td>
<td>One coat PrepRite ProBlock</td>
<td>Two coats ProMar 200 Interior Latex Flat</td>
</tr>
<tr>
<td>(Ceilings)</td>
<td>Primer/sealer</td>
<td></td>
</tr>
<tr>
<td>SUBSTRATE</td>
<td>PRIMER</td>
<td>TOP COATS</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>----------------------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Gypsum board, satin finish (Walls)</td>
<td>One coat PrepRite ProBlock Interior/Exterior Latex Primer/sealer</td>
<td>Two coats ProMar 200 Interior Latex Eg-Shel</td>
</tr>
<tr>
<td>Ferrous and galvanized metals (Hollow metal doors &amp; frames)</td>
<td>One coat Pro Industrial Pro-Cryl Universal Primer</td>
<td>Two coats Pro Industrial Water Based Alkyd Urethane Enamel</td>
</tr>
<tr>
<td>Wood, transparent finish (Standing &amp; Running Trim)</td>
<td>One coat Wood Classics Interior Oil Stain</td>
<td>Two coats Wood Classics Polyurethane Varnish, Satin</td>
</tr>
<tr>
<td>Concrete, transparent finish (Floors)</td>
<td>None</td>
<td>Two coats H &amp; C Clear Liquid Hardener &amp; Densifier</td>
</tr>
<tr>
<td>Quarry tile, transparent finish (Floors)</td>
<td>Refer to Spec. Sect.09 30 13 – Ceramic Tiling</td>
<td>Two coats SB Stone, Tile &amp; Grout Sealer as manuf. By Mapei</td>
</tr>
</tbody>
</table>

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Cutout dimensional characters at the following locations:
      a. Exterior Building Sign at the east façade of the Milam County Annex

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For dimensional letter signs.
   1. Include fabrication and installation details and attachments to other work.
   2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
   3. Show message list, typestyles, graphic elements, and layout for each sign at least ¾” = 1'-0”.

C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

   1. Warranty Period: five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 DIMENSIONAL CHARACTERS

A. Cutout Characters: Characters with uniform faces; square-cut edges; precisely formed lines and profiles; and as follows:

   1. Character Material: Sheet or plate aluminum.
   2. Character Height: As indicated.
3. Thickness: **As indicated**.

4. Finishes:
   a. Integral Aluminum Finish: **Clear anodized**.

5. Mounting: **As indicated**.

### 2.2 ACCESSORIES

**A.** Fasteners and Anchors: Manufacturer’s standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish **stainless-steel** devices unless otherwise indicated.
3. Exposed Metal-Fastener Components, General:
   a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.

**4.** Sign Mounting Fasteners:

   a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
   b. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, installed in predrilled holes.

**B.** Adhesives: As recommended by sign manufacturer and with a VOC content of [70] <insert value> g/L or less for adhesives used inside the weatherproofing system and applied on-site when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

**C.** Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

### PART 3 - EXECUTION

**3.1 INSTALLATION**

**A.** General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

**B.** Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
   a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

2. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.

3. Back Bar and Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position so that signage is correctly located and aligned.

4. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.

C. Remove temporary protective coverings and strippable films as signs are installed.

END OF SECTION
SECTION 10 14 23
SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interior room signs.
   2. Exterior post mounted signs for accessible parking spaces.
   3. Exterior post and panel directional site signs.

B. Related Sections:
   1. Division 1: Administrative, procedural, and temporary work requirements.
   2. Section 03 30 00 – Cast-In-Place Concrete for concrete fill in post holes.
   3. Section 09 29 00 – Gypsum Board Assemblies for attachment of signage to gypsum board walls.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM B 209 for 5005-H15

1.3 SUBMITTALS

A. Product data: For each type of sign specified, including details of construction relative to materials, dimensions of individual components, anchorage details, accessories, profiles, and finishes. Include not less than half-size details of wording and graphic layout.

B. Samples for Interior Signs and Exterior Post Sign:
   1. Submit manufacturer’s samples for initial selection of color, pattern, and texture for each exposed finish.
   2. Submit samples for each type of material proposed for use.

C. Installation: Submit supplier’s installation instructions.

D. Warranty: Submit manufacturer’s standard warranty document executed by authorized company official.

1.4 QUALITY ASSURANCE

A. New Sign Fabricator Qualifications: Firm experienced in producing signs similar to those indicated for this Project, with a record of successful in-service performance, and sufficient production capacity to produce sign units required without causing delay in the Work.

B. Single-Source Responsibility: For each sign type required, obtain signs from one source of a single manufacturer.

C. Design Concept: The Specifications indicate sizes, profiles, and dimensional requirements of signs and are based on the specific types and models indicated. Sign units by other manufacturers may be considered provided deviations in dimensions and profiles do not change the design concept as judged by the Architect.
D. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including dimensions, anchorage, all details, elevations, plans and sections required to indicate all conditions.

E. Mock up: 1 full size mock-up of Interior & Exterior Post signs.

F. Regulatory Requirements: Products shall meet requirements of the Americans With Disabilities Act Accessibility Guidelines (ADAAG), Texas Accessibility Standards (TAS), and other local amendments and modifications.

1.5 PROJECT CONDITIONS

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay.

1.6 PRODUCT HANDLING AND PROTECTION

A. Deliver materials to Project site in original packages, containers, or bundles, labeled with manufacturer’s name, product brand name, and lot number.

B. Store materials inside, under cover, and dry, protected from weather, direct sunlight, surface contamination, aging, corrosion, and damage from construction traffic and other causes.

C. Protect metal accessories from being bent or damaged.

PART 2- PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Interior Panel Signs & Exterior Post and Panel Signs:
      11106 Morrison Lane
      Dallas, TX 75229
      (214) 352-7446
   b. Mohawk Sign Systems, Inc.
      Architectural Graphics
      P. O. Box 966
      Schenectady, NY 12301
      518.370.3433
      518.370.3332 (fax)

2. Exterior Post Mounted Signs:
   a. Brimar Industries Incorporated Co.
      PO Box 467
      64 Outwater Lane
      Garfield, New Jersey 07026

2.2 MATERIALS

A. INTERIOR PANEL SIGNS
1. **General:** Sand-Carved hard plastic ES/MP plastic laminate, in sizes and thicknesses indicated, with a minimum flexural strength of 16,600 psi when tested according to ASTM D790, with a minimum allowable continuous service temperature of 176 deg F (80 degC). Provide in colors and finishes as selected from the manufacturer’s standards.
   a. Fasteners: Use concealed fasteners fabricated from metals that are not corrosive to the sign material and mounting surface.
   b. Anchors and Inserts: Use non-ferrous metal or hot-dipped galvanized anchors and inserts for installation. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.
   c. Colored for plastic laminate: Use colored coatings, including inks and paints for copy and background colors that are recommended by manufacturer and are non-fading for the application intended.
   d. Graphic Content and Style: Provide sign copy that complies with the requirements indicated for size, style, spacing, content, position, material, finishes, and colors of letters, numbers, and other graphic devices.

2. **Product:** Custom frameless plaque as manufactured by Mohawk Sign Systems, Inc.; Refer to 3.3, Interior Sign Schedule.
   a. Material: 1/4” thick hard phenolic ES/MP plastic laminate.
   b. Fabrication: Sand-Carved process.
   c. Backplate: Provide a 1/8” thick backplate to space sign off wall. Edges of backplate to be black. Adhere backplate to back of 1/4” thick phenolic ES/MP plastic laminate with permanent 4 mil thick double face film tape.
   d. Finish: Polyurethane coating system, surface preparation and application as recommended by coating system manufacturer. Paint face and edge color to be determined. Tip raised borders and copy with color to be determined. Braille does not tip.
   e. Graphics: Provide border, tactile copy and grade 2 Braille raised 1/32 inch minimum from plaque first surface by manufacturer’s photopolymer bonded process. Adhesive-fixed characters are not acceptable. Produce precisely formed characters with square edges free from burrs and cut marks. Provide lettering and graphics precisely formed, uniformly opaque to comply with relevant ADA regulations and requirements indicated for size, style, spacing, content, position, and colors. Computerized translation of sign copy to be responsibility of the manufacturer.
   f. Letters and Characters: To be upper case text, font to be determined, and meet ADA requirements regarding character proportion.

B. **EXTERIOR POST MOUNTED SIGNS**

1. **Posts:** Provide manufacturer’s standard 0.125-inch-thick structural aluminum tubing extruded from 6063-T5 alloy. Include post caps and related accessory items required for a complete installation. Comply with the following requirements for post shape, finish, and mounting method:
   2. Post Shape: 2-inch diameter
   3. Aluminum Sheet or Plate: Provide alloy and temper recommended by the aluminum producer or finisher for the type of use and finish indicated and with not less than the strength and durability properties specified in ASTM B 209 for 5005-H15.
   4. Fasteners: Unless otherwise indicated, use fasteners fabricated from metals that are non-corrosive to either the sign material or the mounting surface.
   5. Product: Aluminum non-reflective sign by Brimar, model #T4622 with Federal Van Accessible Sign.

C. **EXTERIOR POST & PANEL DIRECTIONAL SITE SIGNS**

1. **Material:**
   a. Framing: Extruded aluminum tubing, square and round as indicated. Square tubing shall have square corners.
b. Faces: Min. 0.125" thick aluminum sheet on both faces.
c. Plate: ½" aluminum plate as indicated.

2. Fabrication:
a. Fabricate frames by welding.
b. Attach faces to frames by welding or with permanent adhesives.
c. Visible welds are not permitted. Blistering or deformation of faces caused by welding faces to framing is not permitted.
d. Do not use bondo or other fillers.
e. Route ½" plate to shapes indicated. Cut marks on routed parts are not permitted.
f. Curves shall be smooth and true.
g. Returns on sign panel shall be continuous.
h. Locate seam in return on bottom of panel.

3. Finish:
a. Powder coated.
b. Base bid is color selected from manufacturer's standard color chart.

4. Graphics:
a. Pressure Sensitive Vinyl. 3M Scotchcal Premium Grade.
b. Color as selected from manufacturer's standard color chart.

5. Mounting: Extend posts 24" into concrete footing; hold top of footing 4" below finish grade; replace grass.

6. Product:
a. Custom post and panel sign as manufactured by 3D-G; Refer to 3.4 Exterior Sign Schedule.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions. Install signs level, plumb, and at the height indicated with sign surfaces free from distortion or other defects.

B. Wall-Mounted Panel Signs: Attach panel signs to wall surfaces, according to the requirements of the American Disability Act, at 60" above the finished floor to the centerline of the sign on the latch side of the door, using the method indicated below. If there is less than 18" between door casing and intersecting wall, center sign horizontally in the space available. If there is more than 18" between door frame and intersecting wall, locate sign 3" from door casing. Where there is no wall space to the latch side of the door, including at double leaf doors, signs shall be placed on the nearest adjacent wall.

C. Shim Plate Mounting: Provide 1/8-inch-thick concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other mounting methods are not practicable. Attach the plate with fasteners and anchors suitable for secure attachment to the substrate. Attach panel sign units to the plate using the method specified above.

D. Install Signs: level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearances.

E. Post Signs: Set posts in concrete footings as indicated.
F. Signage Placement: Prior to installation, contractor shall mark proposed signage location on wall or on site and coordinate review by Owner and Architect for review and acceptance.

3.2 CLEANING AND PROTECTION:

A. After installation, clean soiled sign surfaces according to the manufacturer’s instructions. Protect units from damage until acceptance by the Owner.

B. Repair scratches and other damage which might have occurred during installation. Replace components where repairs were made but are still visible to the unaided eye from a distance of five feet.

3.3 INTERIOR SIGNAGE SCHEDULE:

A. All signage to be in compliance with the Americans with Disabilities Act of 2012 and the Texas Accessibility Standards. Mount new signage according to the mounting height requirements of ADA. Refer to Schedule and Drawings for sizes, locations, and layout of signage types, sign text copy, and graphics.

### MILAM COUNTY ANNEX

<table>
<thead>
<tr>
<th>Door No.</th>
<th>Quantity</th>
<th>Inscription</th>
<th>Interior</th>
<th>Size/Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>101C</td>
<td>1</td>
<td>Mail &amp; Copy Room</td>
<td>Interior</td>
<td>6” x 8 ½”</td>
</tr>
<tr>
<td>101F</td>
<td>1</td>
<td>Mechanical Room</td>
<td>Interior</td>
<td>6” x 8 ½”</td>
</tr>
<tr>
<td>101G</td>
<td>1</td>
<td>Women’s Restroom (Include the international symbol for accessibility)</td>
<td>Interior</td>
<td>6” x 8 ½”</td>
</tr>
<tr>
<td>101H</td>
<td>1</td>
<td>Men’s Restroom (Include the international symbol for accessibility)</td>
<td>Interior</td>
<td>6” x 8 ½”</td>
</tr>
<tr>
<td>101J</td>
<td>1</td>
<td>Conference Room</td>
<td>Interior</td>
<td>6” x 8 ½”</td>
</tr>
<tr>
<td>101K</td>
<td>1</td>
<td>IT Room</td>
<td>Interior</td>
<td>6” x 8 ½”</td>
</tr>
<tr>
<td>101L</td>
<td>1</td>
<td>Mechanical Room</td>
<td>Interior</td>
<td>6” x 8 ½”</td>
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<td>101M</td>
<td>1</td>
<td>Breakroom</td>
<td>Interior</td>
<td>6” x 8 ½”</td>
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Milam County Annex  
Cameron, Texas  
10 14 23 - 7  
Signage
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Interior Room Sign

EDGE OF PLAQUE BEVEL \( \frac{1}{8}" \)

BORDER, COPY AND BRAILLE ARE RAISED \( \frac{1}{8}" \)

1/4" THICK HARD PHENOLIC ES/MP PLASTIC LAMINATE

5"x7 \( \frac{3}{4} " \times \frac{3}{4} " \) THICK BLACK BACKPLATE CENTERED ON BACK OF PLAQUE

ADHERE TO WALL WITH \( \frac{1}{8} " \) FOAM TAPE AND SILICON

ELECTRONIC ARTWORK WILL BE PROVIDED FOR COPY LAYOUTS; SIGN CONTRACTOR TO FURNISH GRADE 2 BRAILLE.
3.4 EXTERIOR SIGNAGE SCHEDULE:

A. All signage to be in compliance with the Americans with Disabilities Act of 2012 and the Texas Accessibility Standards. Mount new signage according the mounting height requirements of ADA. Refer to Schedule and Drawings for sizes, locations, and layout of signage types, sign text copy, and graphics.

<table>
<thead>
<tr>
<th>Quantity</th>
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3.5 EXTERIOR DIRECTIONAL SITE SIGNAGE SCHEDULE:

A. All signage to be in compliance with the Americans with Disabilities Act of 2012 and the Texas Accessibility Standards. Mount new signage according the mounting height requirements of ADA. Refer to Schedule and Drawings for sizes, locations, and layout of signage types, sign text copy, and graphics.

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<th>Quantity</th>
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END OF SECTION
SECTION 10 28 00
TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Paper towel dispenser and waste receptacle.
   2. Hand dryer.
   4. Toilet tissue dispenser.
   5. Framed mirror.
   7. Sanitary waste receptacle.
   8. Grab bars.
  10. Under lavatory pipe covers.
  11. Attachment hardware.

B. Related Sections:
   1. Division 1: Administrative, procedural, and temporary work requirements.
   2. Section 06 10 00 – Rough Carpentry for wood blocking.
   3. Section 09 29 00 – Gypsum Board Assemblies.
   4. Section 09 30 13 – Ceramic Tiling.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. A 123/A 123M - Zinc (Hot-Galvanized) Coatings on Iron and Steel Products.
   2. A 269 - Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
   3. A 480/A 480M - Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
   4. A 666 - Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
   6. C 1036 - Flat Glass.

1.3 SUBMITTALS

A. Product Data: Manufacturer's brochures showing sizes, details of function, finishes, and attachment methods.

B. Setting Drawings: Provide setting drawings, templates, instructions, and directions for installation of anchorage devices in other work.

C. Submit schedule of accessories indicating quantity and location of each item.

D. Samples: One of each accessory, if requested.
1.4 QUALITY ASSURANCE

A. Inserts and Anchorages: Furnish inserts and anchoring devices which must be set or built into masonry; coordinate delivery with other work to avoid delay.

B. Accessory Locations: Coordinate accessory locations with other work to avoid interference and to assure proper operation and servicing of accessory units. Height of accessories shall be installed in compliance with applicable accessibility code.

C. Products: Unless otherwise noted, provide products of same manufacturer for each type of unit and for units exposed in same areas.

1.5 PRODUCT HANDLING

A. Deliver accessories to the site ready for use in the manufacturer’s original and unopened containers and packaging, bearing labels as to type of material, manufacturer’s name and brand name.

1.6 WARRANTY

A. Mirrors:
   1. Warranty period: 10 years.
   2. Warrant against silver spoilage resulting from manufacturing defects.

1.7 MAINTENANCE

A. Label keys and forward directly to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:
   1. A and J Washroom Accessories.
   2. American Specialties, Inc.
   4. Bradley Corp.
   5. General Accessory Manufacturing Co.
   6. IPS Corporation, www.truebro.com

B. Substitutions: Under provisions of Division 1.

2.2 MATERIALS

A. Stainless Steel:
   1. Sheet: ASTM A 480/A 480M or ASTM A 666; Type 304,rollable temper.
   2. Tubing: ASTM A 269.


C. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q1.
2.3 ACCESSORIES
   A. Fasteners: Stainless steel where exposed, hot dip galvanized where concealed; type best suited to substrate conditions.

2.4 FABRICATION
   A. Use stainless steel for exposed surfaces; galvanized steel may be used in concealed locations.
   B. Form exposed surfaces from single sheet of stock, free from joints, and flat, without distortion.
   C. Weld joints of fabricated components and grind smooth.
   D. Fabricate grab bars of tubing, free of visible joints, return to wall with end attachment flanges. Peen grip surfaces.
   E. Fabricate soap dispensers to operate with less than 5 pound force.
   F. Provide hangers, adapters, anchor plates, and accessories required for installation.
   G. Key locks alike; furnish six keys.
   H. Mirrors:
      1. Frame: One piece, roll formed stainless steel channel, 1/2 x 1/2 inch, with corners mitered.
      2. Mirror: Apply one coat of silver, one coat of electroplated copper, and one coat of organic mirror backing compound to back surface of glass.
      4. Isolate glass from frame and backing with resilient, waterproof padding.
      5. Shop assemble units and package complete with anchors and fittings.
      6. Finishes:
         a. Stainless steel: No. 4 satin.
         b. Galvanizing: ASTM A 123/A 123M to 1.25 ounces per square foot.
         c. Chrome plating: ASTM B 456, Type SC 2, polished finish.
         d. Polyethylene: White.

PART 3 - EXECUTION

3.1 INSPECTION
   A. Examine the areas and conditions where toilet accessories are to be installed and notify the Architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 PREPARATION
   A. Accessories which are to be partition mounted shall be closely coordinated with other trades, so that the necessary reinforcing is provided to receive the accessories.
   B. Furnish templates and setting drawings and anchor plates required for the proper installation of the accessories at gypsum drywall and masonry partitions. Coordinate the work to assure that base plates and anchoring frames are in the proper position to secure the accessories.
C. Verify by measurements taken at the job site those dimensions affecting the work. Bring field dimensions, which are at variance with those on the approved shop drawings to the attention of the Architect. Obtain decision regarding corrective measures before the start of fabrication of items affected.

D. Cooperate in the coordination and scheduling of the work of this Section with the work of other Sections so as not to delay job progress.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Set plumb, level, square, and rigidly anchored.

3.4 CLEANING AND PROTECTION

A. Upon completion of the installation, clean accessories of dirt, paint and foreign matter.

B. Replace and/or repair installed work, which is damaged or defective at no additional cost.

3.5 SCHEDULE

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>MANUFACTURER</th>
<th>CATALOG NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Speed Hand Dryer with Hepa Filter</td>
<td>American Specialties</td>
<td>0196</td>
</tr>
<tr>
<td>Recessed Paper Towel Dispenser &amp; Waste Receptacle</td>
<td>American Specialties</td>
<td>0469</td>
</tr>
<tr>
<td>Surface-Mounted Paper Towel Dispenser &amp; Waste Receptacle</td>
<td>American Specialties</td>
<td>04697-9</td>
</tr>
<tr>
<td>Surface Mounted Twin Hide-A-Roll Toilet Paper Dispenser</td>
<td>American Specialties</td>
<td>20030</td>
</tr>
<tr>
<td>Inter-Lok Stainless Steel Framed Mirror</td>
<td>American Specialties</td>
<td>0600</td>
</tr>
<tr>
<td>Automatic Soap Dispenser</td>
<td>American Specialties</td>
<td>20364</td>
</tr>
<tr>
<td>Surface-Mounted Sanitary Waste Receptacle</td>
<td>American Specialties</td>
<td>20852</td>
</tr>
<tr>
<td>1 ½” Diameter Stainless Steel Grab Bars with Snap Flange Covers</td>
<td>American Specialties</td>
<td>3800 x lengths indicated on the Drawings</td>
</tr>
<tr>
<td>Surface-Mounted Stainless Steel Baby Changing Station</td>
<td>American Specialties</td>
<td>9013</td>
</tr>
<tr>
<td>Single Robe Hook</td>
<td>American Specialties</td>
<td>7340-S</td>
</tr>
<tr>
<td>Under Lavatory Pipe Cover</td>
<td>TRUEBRO</td>
<td>Lav Guard 2 Series #100 E-Z</td>
</tr>
</tbody>
</table>

Note: All accessories to have No. 4 satin finish.

END OF SECTION
PART 1 - GENERAL

SUMMARY

A. Section Includes:
   1. Portable fire extinguishers in mechanical and electrical rooms
   2. Cabinets in public areas
   3. Accessories

B. Related Sections:
   1. Division 1: Administrative, procedural, and temporary work requirements.
   2. 09 29 00 – Gypsum Board Assemblies.

1.2 REFERENCES

A. Underwriters Laboratories (UL) (www.ul.com):
   1. 299 - Dry Chemical Fire Extinguishers.

B. ADA Accessibility Guidelines


1.3 SUBMITTALS

A. Shop Drawings: Indicate cabinet and bracket locations and mounting heights.

B. Product Data: Include data on extinguishers and cabinets, brackets, cabinet dimensions, operational features, materials, finishes, and anchorage.

C. Maintenance Data: Include test, refill, or recharge schedules and re-certification requirements.

1.4 QUALITY ASSURANCE

A. Provide fire extinguishers complying with UL 711 and NFPA 10.

B. Cabinets in Fire Rated Partitions: Tested in accordance with ASTM E814 with fire resistance rating equivalent to adjacent construction.

C. Conform to applicable accessibility code for locating extinguishers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:
   2. Ansul Incorporated. (www.ansul.com)
   3. Potter Roemer. (www.potterroemer.com)

B. Substitutions: Under provisions of Division 1.
2.2 COMPONENTS

A. Fire Extinguishers:
   1. Public Corridors: Multi-purpose dry chemical type, UL 299, cast steel tank, Class 4A:60B:C, 10 pound nominal capacity.
   2. Secondary Spaces (Mechanical and Electrical Rooms): Multi-purpose dry chemical type, UL 299, cast steel tank, Class 2A:10B:C, 5 pound nominal capacity.

B. Cabinets for Extinguishers in Public Corridors (Provide as needed to supplement existing cabinets to meet requirements of local code official):
   1. General:
      a. Formed steel sheet, 18-gauge minimum.
      b. Configuration: Recessed, sized to accommodate extinguisher.
      c. Trim: Flat trim.
      d. Door:
         1) Emergency opening without breaking the glass, equipped with pull handle and lock. Key locks alike; furnish six keys.
         2) Hinge doors for 180 degree opening with continuous piano hinge.
         3) Glazing: Clear tempered glass.
   2. Product: Larsen’s Architectural Series, model number 2409-R2, with Vertical Duo Door with Larsen-Loc.

C. Brackets for Extinguishers in Secondary Spaces: Formed steel, sized to accommodate extinguisher.

2.3 ACCESSORIES

A. Mounting Hardware: Type best suited to application.

2.4 FINISHES

A. Cabinet:
   1. Exterior and door: Aluminum, clear satin anodized finish.
   2. Interior: Aluminum, clear satin anodized finish.

B. Brackets: Baked enamel, white color.

C. Extinguishers: Baked enamel, red color.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cabinets and brackets in accordance with manufacturer’s instructions.

B. Set plumb, level, and rigid.

C. Place an extinguisher in each cabinet and on each bracket.

END OF SECTION
SECTION 10 73 16
CANOPIES

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Building supported, pre-engineered metal canopies including fascia
      channels, decking, tension rods, and attachment hardware.
B. Related Sections:
   1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 REFERENCES
A. Aluminum Association (AA)DAF 45 - Designation System for Aluminum Finishes.
B. American Architectural Manufacturers Association (AAMA)
   1. 2603 - Voluntary Specification, Performance Requirements and Test
      Procedures for Pigmented Organic Coatings on Architectural Extrusions
      and Panels.
C. American Society of Civil Engineers (ASCE) 7 - Minimum Design Loads for
   Buildings and Other Structures.
D. ASTM International (ASTM)
   1. B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded
      Bars, Rods, Wire, Profiles, and Tubes.

1.3 SYSTEM DESCRIPTION
A. Design Requirements: Design canopy system to withstand:
   1. Standards for wind pressure, snow load, and drifting snow load in
      accordance with current adopted from of the 2018 International Building
      Code.

1.4 SUBMITTALS
A. Submittals for Review:
   1. Shop Drawings: Indicate system components, dimensions, attachments, and
      accessories.
   2. Samples:
      a. 3 x 3 inch coating samples in specified color.
      b. 6 inch long fascia extrusion sample showing profile and standard finish.
      c. 6 inch decking samples showing profile and finish.

1.5 QUALITY ASSURANCE
A. Installer Qualifications: Minimum 5 years experience in installation of MASA
   products.
   1. (Mockup: Provide mockup of canopy system including all framing
PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Contract Documents are based on:
   Extrudeck
   By: MASA Architectural Canopies
   21 Randolph Ave.
   Avenel, NJ 07001
   800-761-7446

B. Acceptable alternates:

   Other manufacturers may bid only after written approval of the architect, obtained 10 days prior
to bid opening and issued by addendum. Interested manufacturers must furnish full details of
proposed product, engineering calculations on all sections involved, physical samples of all
shapes and finishes, a list of installations similar in size and design, and must have a minimum of
five years experience in manufacturing and installing extruded aluminum louver systems.

2.2 MATERIALS

A. Aluminum Extrusions: ASTM B221 & ASTM B429 6061-T6 alloy and temper.
B. Hardware: All fasteners shall be stainless steel.

2.3 COMPONENTS

A. Framing: Type: 8” X .125” Extruded aluminum “J” channel (6063-T5).
B. Decking: 3” x 6” x .090” Interlocking Extruded Aluminum Flat Soffit Decking (6063-T5). Provide option
d for round light box, coordinate with MEP for light fixture.
C. Mounting: Hanger Rod Supported – 3” x 2 ½” x ¼” I-Beam Outriggers (6061-T6511) w ¾” D
   Schedule 40 Steel Pipe (A500) Escutcheon Plate – 6 SQU (S):
D. Profile / Crown
   1. Profile Variables: None
   2. Crown Variables: None
E. Other Components: other components as indicated or as required for system attachment and
   performance.

2.4 ACCESSORIES

A. Anchors and Fasteners. Stainless steel

2.5 FABRICATION

A. Fabricate canopy system in accordance with approved Shop Drawings.
B. All canopies to be mechanically assembled with a minimum shear stress strength of 350lbs. Pre-
welding is not acceptable

C. Drainage system to be concealed type. Covered surfaces direct water to field drilled drain, to be coordinated at site.

2.6 FINISHES

A. Aluminum:
   1. Pre-Treatment: Pre-treat to ASTM D1730 type B, Method 5 using a multi stage chromate process or an approved chrome-free pretreatment process approved by powder coating manufacturer for optimized weather resistance.
   2. Finish coat: AAMA 2603 Thermosetting Polyester Resin-based Powder
   3. Source: Tiger Drylac powder coating or equivalent.
   4. Color: To be selected by architect from MASA color range

PART 3 - EXECUTION

3.1 FIELD DIMENSIONS

A. Field verify dimensions of supporting structure at site of installation prior to fabrication.

3.2 INSTALLATION

A. Install in accordance with manufacturer’s instructions and approved Shop Drawings.

B. Install components plumb and level, in proper plane, free from warp and twist.

C. Anchor system to building components; provide adequate clearance for movement caused by thermal expansion and contraction and wind loads.

3.3 ADJUSTING

A. Touch up minor scratches and abrasions on finished surfaces to match original finish.

END OF SECTION
SECTION 12 36 61
QUARTZ COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Quartz surfacing for countertops and backsplash in breakrooms, 101M, 109N, and 105N.
   2. Setting materials and accessories.

B. Related Sections:
   1. Division 1: Administrative, procedural, and temporary work requirements.
   2. Section 06 10 0 – Rough Carpentry.
   3. Section 06 41 00 – Custom Cabinets for plastic laminate countertops.
   4. Section 07 92 00 – Joint Sealers.

1.2 REFERENCES

A. American National Standards Institute
   1. ANSI Z124.6 Stain Resistance.

B. American Society for Testing and Materials (ASTM):
   1. C 97 Absorption and Bulk Specific Gravity of Dimension Stone.
   5. C482 Bond Strength of Ceramic Tile to Portland Cement.
   7. C501 Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser.
   8. C531 Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
   10. C1028 Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.
   12. D 2047 Static Coefficient of Friction of Polish-Coated Floor Surfaces by the James Machine.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer’s product data, care and maintenance data.

B. Samples: Submit two sets of manufacturer’s standard colors and finishes.

C. Submit two 6” samples of adhesive joint for each color quartz surface selected.

D. Shop Drawings: Include countertop layout, dimensions, required locations of support and blocking members, edge profiles, cutouts and attachments.
1.4 QUALITY ASSURANCE

A. Fabricator/Installer Qualifications:
   1. Provide manufacturer’s ten-year limited warranty against product defects when fabricated and installed by a fabricator certified by the manufacturer.
   2. Fabricator shall be certified in writing by Manufacturer.

B. Mockup:
   1. Size: Full size countertop.
   2. Locate where directed.
   4. Approved mockup may remain as part of work.

1.5 DELIVERY, STORAGE, AND HANDLING:

A. Packaging, Shipping, Handling and Unloading: Observe manufacturer’s recommendations and handle in a manner to prevent breakage. Brace parts if necessary. Transport in near vertical position with finished face toward finished face. Do not allow finished surfaces to rub during shipping and handling.

B. Storage and Protection: Store in racks in near vertical position. Prevent warpage and breakage. Store inside away from direct exposure to sunlight. Store between 25 and 130 degrees F. Store with finished face toward finished face.

1.6 WARRANTY

A. Closeout Submittals:
   1. Provide manufacturer’s completed warranty form.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer’s:
   1. CaesarStone

B. Substitutions: Under provisions of Division 1.

2.2 MATERIALS

A. Countertop and Backsplash:
   1. Homogeneous mixture containing 93% crushed quartz combined with resins and pigments and fabricated into slabs using a vacuum vibro-compaction process.
   2. Thickness: ¾” thick with ¾” thick backsplash.
   4. Edge Detail: Eased edge.
   5. Color: #9141 Ice Snow
   6. Performance:
      a. Moisture Absorption: typical results 0.02%; ASTM C97
      b. Modulus of Rupture: typical results 6,800 psi; ASTM C99
      c. Compressive Strength: typical results 24,750 psi; ASTM C170
d. Abrasion Resistance: typical results 223; ASTM C501

e. Bond Strength: typical results 205 psi; ASTM C482

f. Thermal Shock: passes 5 cycles: ASTM 484

g. Coefficient of Thermal Expansion: typical results 1.2x10-5 inch/°F; ASTM C531

h. Breaking Strength of Tile: typical results 3,661 lbf; ASTM C648

i. Resistance to Freeze Thaw Cycling: unaffected 15 cycles; ASTM C1026

j. Coefficient of Friction Pull Method: .75 avg. dry / .55 avg. wet; ASTM C1028

k. Surface Burning Characteristics: typical results 17; ASTM E84

l. Smoke Density: flaming 196, non-flaming 69; ASTM E662

m. Stain Resistance: Unaffected; ANSI Z124.6

2.3 ACCESSORIES

A. Mounting Adhesives: Provide structural-grade silicone or epoxy adhesives of type recommended by manufacturer for application and conditions of use.

1. Acceptable Manufacturers:
   a. Dow Corning.
   b. GE Sealants and Adhesives.

B. Stone Adhesive: Provide epoxy or polyester adhesive of type recommended by manufacturer for application and conditions of use

1. Acceptable Manufacturers:
   c. Tenax USA.

2. Color: Adhesive which will be visible in finished work shall be tinted to match quartz surfacing.

C. Joint Sealer: Specified in Section 07 92 00.

D. Cleaning Agents: Non-abrasive, soft-scrub type kitchen cleansers.

2.4 FABRICATION

A. Layout: Layout surface to minimize joints and avoid L-shaped pieces of quartz surfacing. Layout and fabricate with hairline joints.

B. Inspection of Materials: Inspect materials for defects prior to fabrication.

C. Tools: Cut and polish with water cooled powered tools.

D. Cutouts:

1. Cutouts shall have a minimum of 3/8" radius.

2. Where edges of cutouts will be exposed in finished work; polish edges.

E. Laminations: Laminate layers of quartz surfacing as required to create built up edges following procedures recommended by the manufacturer.
PART 3 - EXECUTION

3.1 INSTALLER

A. Installation shall be by a certified Installer, certified in writing by Manufacturer.

3.2 PRE-INSTALLATION EXAMINATION

A. Site Verification:
   1. Verify dimensions by field measurements prior to installation.
   2. Verify that substrates supporting quartz surfaces are plum, level and flat to within 1/8 inch in 10 feet and that all necessary supports and blocking are in place.

B. Inspection of Quartz Surfaces: Inspect materials for defects prior to installation.

3.3 PREPARATION

A. Prepare Surface: Clean surfaces prior to installation.

B. Protection of Quartz Surfaces: Protect finished surfaces from scratches. Apply masking where necessary. Take necessary precautions to prevent dirt, grit, dust, and debris from other trades from contacting the surface.

3.4 INSTALLATION

A. Install materials in accordance with manufacturer’s instructions and approved shop drawings.

B. Preliminary Installation:
   1. Position materials to verify the correct size.
   2. If size adjustments, or additional fabrication is necessary, use water-cooled tools. Protect jobsite and surface from dust and water. Perform work away from installation site if possible.
   3. Allow gaps for expansion of not less than 1/8 inch per ten feet when installed between walls or other fixed structure.

C. Permanent Installation:
   1. After verification of fit and finish, clean substrate; remove loose and foreign matter which may interfere with adhesion. Clean quartz surface backside & joints with denatured alcohol.
   2. Horizontal surface: Apply continuous bead of mounting adhesive around perimeter or structural substrate and supports.
   3. Vertical surface: Apply continuous bead of mounting adhesive around perimeter. In addition, apply ¼ inch mounting adhesive bead every 8 inches on vertical center.
   4. Install quartz surfacing plumb, level, square, and flat to with 1/8 inch in ten feet, non-cumulative.
   5. Align adjacent pieces in same plane.

D. Joints:
   1. Joints between adjacent pieces of quartz surfacing:
      a. Joints shall be flush, tight fitting, level and neat.
      b. Securely join adjacent pieces with recommended adhesive.
      c. Fill joints level to polished surface.
      d. Secure adjacent quartz surfaces with vacuum clamps until adhesive hardens.
3.5 REPAIR
   A. Repair or replace damaged material in a satisfactory manner.

3.6 CLEANING
   A. Remove masking, excessive adhesive and sealants. Clean exposed surfaces with denatured alcohol.

END OF SECTION
SECTION 20 05 00

BASIC MECHANICAL, PLUMBING, & FIRE PROTECTION 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. Basic and supplemental requirements common to Mechanical, Plumbing and Fire Protection Work.

1.3 REFERENCE STANDARDS
A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the Contract Documents and the following references.
D. Section 01 35 46 Construction IAQ Management
   1. Austin Energy Green Building Program (AEGB) Basic Requirements 7 - Low Emitting Materials – Interior Paints and Coatings

1.4 DEFINITIONS
A. These definitions are included to clarify the direction and intention of these Specifications. For further clarification, contact the Architect/Engineer.
   1. Concealed / Exposed: "Concealed" areas are those areas that cannot be seen by the building occupants. "Exposed" areas are all areas, which are exposed to view by the building occupants, including under counters, inside cabinets and closets, plus all mechanical rooms. “Exterior” areas are those that are outside the building exterior envelope and exposed to the outdoors.
   2. Furnish: The term "furnish" is used to mean "supply and deliver to the Project Site, ready for unloading, unpacking, assembly, installation, and similar operations.
   3. Install: The term “install” is used to describe operations at Project Site including the actual “unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
   4. Provide: The term “provide” means “to furnish and install, complete and ready for the intended use.

1.5 QUALITY ASSURANCE
A. Mechanical, Plumbing and Fire Protection systems shall be coordinated with other systems and trades to include but not be limited to: Electrical systems, fire alarm, security systems, transport systems, telephone and data systems.
B. Verification of Dimensions: The Contractor shall be responsible for the coordination and proper relation of Contractor’s Work to the building structure and to the Work of all trades. The Contractor shall visit the premises and become thoroughly familiar with all details of the Work and working conditions, to verify all dimensions in the field, and to advise the Architect/Engineer of any discrepancy before performing any Work. Adjustments to the Work required in order to facilitate a coordinated installation shall be made at no additional cost to the Owner or the Architect/Engineer.

C. All dimensional information related to new structures shall be taken from the appropriate Drawings. All dimensional information related to existing facilities shall be taken from actual measurements made by the Contractor on the Site.

D. The Drawings are subject to the requirements of Reference Standards, 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 organized and laid out so that it will be concealed in furred chases and suspended ceilings, etc., in finished portions of the building, unless specifically noted to be exposed. All exposed Work shall be installed parallel or perpendicular to the lines of the building unless otherwise noted.

E. When the Drawings do not give exact details as to the elevation of pipe and ducts, the Contractor shall physically arrange the systems to fit in the space available at the elevations intended with proper grades for the functioning of the system involved. Piping and duct systems are generally intended to be installed true and square to the building construction, and located as high as possible against the structure in a neat and workmanlike manner. The Drawings do not show all required offsets, control lines, pilot lines and other location details. Work shall be concealed in all finished areas.

F. Where core drilling of floor or wall penetrations is required, Work shall be performed in accordance with Division 03 Specifications. Where applicable Division 03 Specifications are not included in the Project, core drilling shall be in accordance with generally accepted standards, and be performed by licensed personnel where applicable.

G. Certify in writing that neither the Contractor nor any of Contractor’s subcontractors or suppliers will supply any materials that contain any asbestos in any form for this Project.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate mechanical, plumbing and fire protection equipment installation with other building components.

B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical, plumbing and fire protection installations.

C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.

D. Sequence, coordinate, and integrate installations of mechanical, plumbing and fire protection materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.

E. Coordinate connection of mechanical, plumbing and fire protection systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

F. Coordinate requirements for access panels and doors if mechanical items requiring access are concealed behind finished surfaces. Access panels and doors are specified in Section 08 31 13 - "Access Doors and Frames."

G. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.
1.7 DELIVERY, STORAGE AND HANDLING

A. All equipment, ductwork, piping and materials shall be delivered to the Project Site clean and sealed for protection.

B. Take particular care not to damage the existing construction in performing Work. All finished floors, step treads and finished surfaces shall be covered to prevent any damage by workers or their tools and equipment during the construction of the Project.

C. Equipment and materials shall be protected from rust and dust/debris both before and after installation. Any equipment or materials found in a rusty condition at the time of final inspection must be cleaned of rust and repainted as specified elsewhere in these Specifications.

D. All material affected by weather shall be covered and protected to keep the material free from damage while material is being transported to the Site and while stored at the Project Site.

E. Protect ducts and equipment by sealing openings with plastic.

F. During the execution of the Work, open ends of all piping and conduit, and all openings in equipment shall be closed when Work is not in progress, and shall be capped and sealed prior to completion of final connections, so as to prevent the entrance of foreign matter.

G. All equipment shall be protected during the execution of the Work. All ductwork and equipment shall be sealed with heavy plastic and tape to prevent build-up of dust and debris.

H. All ductwork and air handling equipment shall be wiped down with a damp cloth immediately before installation to ensure complete removal of accumulated dusts and foreign matter.

I. All plumbing fixtures shall be protected and covered to prohibit usage. All drains shall be covered until placed in service to prevent the entrance of foreign matter. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.

J. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.

K. Protect flanges, fittings, and piping specialties from moisture and dirt.

L. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

B. All equipment installed shall have local representation, local factory authorized service, and a local stock of repair parts.

C. Responsibility for furnishing proper equipment and/or material and ensuring that equipment and/or material is installed as intended by the manufacturer, rests entirely upon the Contractor. Contractor shall request advice and supervisory assistance from the representative of specific manufacturers during the installation.

D. All materials, unless otherwise specified, shall be new, free from all defects, suitable for the intended use and of the best quality of their respective kinds. Materials and equipment shall be installed in accordance with the manufacturer's recommendations and the best standard practice for the type of Work involved. All Work shall be executed by mechanics skilled in their respective trades, and the installations shall provide a neat, precise appearance. Materials and/or equipment damaged in shipment or otherwise damaged prior to installation shall not be repaired at the job Site but shall be replaced with new materials and/or equipment.
E. Materials and equipment manufactured domestically are preferred when possible. Materials and equipment that are not available from a domestic manufacturer may be by a non-domestic manufacturer provided they fully comply with Contract Documents.

F. Prevention of Rust: Standard factory finish will be acceptable on equipment specified by model number; otherwise, surfaces of ferrous metal shall be given a rust inhibiting coating.

2.2 NAMEPLATES

A. Each major component of equipment shall have the manufacturer's name, address, and catalog number on a plate securely attached to the item of equipment. All data on nameplates shall be legible at the time of Final Inspection.

B. Nameplates shall be black laminated rigid phenolic with white core. Nameplate minimum size shall be 1 inch high by 3 inches long with 3/16-inch-high engraved white letters.

C. Nameplate Fasteners: Fasten nameplates to the front of equipment only by means of stainless steel self-tapping screws. Stick-ons or adhesives will not be allowed unless the NEMA enclosure rating is compromised, then only epoxy adhesive shall be used to attach nameplates.

D. Nameplate Information: In general, the following information is to be provided for the types of electrical components or enclosures supplied with equipment.

1. Individual Starters, Contactors, Disconnect Switches, and Similar Equipment: Identify the device, and voltage characteristics source and load served.

2.3 WALL, FLOOR AND CEILING PLATES (ESCUTCHEONS)

A. Except as otherwise noted, provide stainless steel or chrome plated brass floor and ceiling plates around all pipes, ducts, conduits, etc., passing exposed through walls, floors or ceilings, in any spaces except underfloor and plenum spaces.

B. Plates shall be sized to fit snugly against the outside of the pipe or against the insulation on lines that are insulated and positively secured to such pipe or insulation.

C. For finished ceiling installation, secure escutcheons to ceiling with escutcheon fasteners.

D. Plates will not be required for piping where pipe sleeves extend ¾-inch or more above finished floor.

E. Round and rectangular ducts shall have closure plates (not chrome plated) made to fit accurately at all floor, wall and ceiling penetrations.

2.4 ROOF PENETRATIONS AND FLASHING

A. Pipe, conduit and duct sleeves, pitch pockets and flashings compatible with the roofing installation shall be provided and installed for all roof penetrations by a contractor qualified in such Work.

PART 3 - EXECUTION

3.1 PREPARATION

A. Cooperate with trades of adjacent, related or affected materials or operations, and with trades performing continuations of this Work in order to effect timely and accurate placing of Work and to coordinate, in proper and correct sequence, the Work of such trades.

B. The size of equipment indicated on the Drawings is based on the dimensions of a particular manufacturer. While other manufacturers may be acceptable, it is the responsibility of the Contractor to determine that the equipment proposed will fit in the space. Fabrication Drawings shall be prepared when required by the Architect/Engineer or Owner to indicate a suitable arrangement.
C. All equipment shall be installed in a manner to permit access to all surfaces. All valves, motors, drives, filters, and other accessory items shall be installed in a position to allow removal for service without disassembly of another part.

D. Space Requirements:
   1. Consider space limitations imposed by contiguous Work in location of equipment and material. Do not provide equipment or material which is not suitable in this respect.
   2. Make changes in material and equipment locations of up to five (5) feet, to allow for field conditions prior to actual installation, and as directed by the Architect/Engineer at no additional cost to the Owner.

E. Contractor shall note that the electrical design and Drawings are based on the equipment scheduled and indicated on the Drawings. Should any equipment be provided requiring changes to the electrical design, the required electrical changes shall be made at no cost to the Owner.

F. Connections for equipment other than Divisions 21, 22, 23:
   1. Rough-in and provide all gas, air, water, steam, sewer, etc. connections to all fixtures, equipment, machinery, etc., furnished by the Owner and/or other trades in accordance with detailed rough-in Drawings provided by the equipment suppliers, by actual measurements of the equipment connections, or as detailed.
   2. After the equipment is set in place, make all final connections and provide all required pipe, fittings, valves, traps, etc.
   3. Provide all backflow preventers and air gap fittings required, using approved devices. In each service line connected to an item of equipment or piece of machinery, provide a shutoff valve. On each drain not provided with a trap, provide a suitable trap.
   4. Provide all ductwork, transition pieces, etc., required for a complete installation of equipment.
   5. If permanently installed air handlers are used during construction, filtration media with a minimum MERV of 8 shall be used at each return grille & replaced immediately prior to occupancy.

3.2 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 manufacturer’s published recommendations.

C. Piping may be run exposed in rooms typically without ceilings such as mechanical rooms, janitor’s closets, tight against pan soffits in exposed “tee” structures, or storage spaces, but only where necessary. Shutoff and isolation valves shall be easily accessible.

D. All pipe, conduits, etc., shall be cut accurately to measurements established at the building and shall be worked into place without springing or forcing. All ducts, pipes and conduits run exposed in machinery and equipment rooms shall be installed parallel to the building lines, except that piping shall be sloped to obtain the proper pitch. Piping and ducts run in furred ceilings, etc., shall be similarly installed, except as otherwise shown. All pipe openings shall be kept closed until the systems are closed with final connections.

E. Prior to the installation of any ceiling material, gypsum, plaster or acoustical board, the Contractor shall notify Owner’s Project Manager so that arrangement can be made for an inspection of the above-ceiling area about to be “sealed” off. The Contractor shall provide written notification to the Owner at least five (5) calendar days prior to the inspection.

F. Precedence of Materials:
   1. The Specifications determine the nature and setting of materials and equipment. The Drawings establish quantities, dimensions and details.
   2. If interference is encountered, the following installation precedence of materials shall guide the Contractor to determine which trade shall be given the “Right of Way”:
      a. Building lines
b. Structural members

c. Structural support frames supporting ceiling equipment

d. Soil and drain piping

e. Vent piping

f. Supply, return and outside air ductwork

g. Exhaust ductwork

h. HVAC water and steam piping

i. Condensate piping

j. Fire protection piping

k. Natural gas piping

l. Domestic water (cold and hot, softened, treated)
m. Refrigerant piping

n. Electrical conduit

3. Coordinate mechanical, plumbing and fire protection systems with transport systems as required to maintain transport system right-of-way.

3.3 TESTING

A. When any piece of mechanical, plumbing and fire protection equipment is operable and it is to the advantage of the Contractor to operate the equipment, Contractor may do so, provided that Contractor properly supervises the operation, and has the Owner’s written permission to do so. The warranty period shall, however, not commence until such time as the equipment is operated for the beneficial use of the Owner, or date of Substantial Completion, whichever occurs first.

B. Regardless of whether or not the equipment has or has not been operated, the Contractor shall properly clean the equipment, install clean filter media, properly adjust, and complete all deficiency list items before final acceptance by the Owner. The date of acceptance and performance certification will be the same date.

C. Before the Work is accepted, an authorized representative of the manufacturer of the installed materials and/or equipment shall personally inspect the installation and operation of manufacturer’s materials and/or equipment to determine that materials and/or equipment are properly installed and in proper operating order. The qualifications of the manufacturer’s representative shall be appropriate to the technical requirements of the installation. The qualifications of the manufacturer’s representative shall be submitted to the Owner for approval. The decision of the Owner concerning the appropriateness of the manufacturer’s representative shall be final. Testing and checking shall be accomplished during the course of the Work where required by Work being concealed, and at the completion of the Work. In addition, the Contractor shall submit to the Architect/Engineer a signed statement from each manufacturer’s representative certifying as follows: “I certify that the materials and/or equipment listed below have been personally inspected by the undersigned authorized manufacturer’s representative and is properly installed and operating in accordance with the manufacturer’s recommendations.”

D. Check inspections shall include piping, equipment, heating, air conditioning, insulation, ventilating equipment, controls, mechanical equipment and such other items hereinafter specified or specifically designated by the Architect/Engineer.

E. The Contractor shall execute, at no additional cost to the Owner, any tests required by the city, state, authority having local jurisdiction or Owner or the National Fire Protection Association, ASTM, etc. Standards listed. The Contractor shall provide all equipment, materials and labor for making such tests.
F. Notify the Owner’s Project Manager and the Architect/Engineer in writing at least seven (7) calendar days prior to each test and prior to other Specification requirements requiring Owner and Architect/Engineer to observe and/or approve tests.

G. All tests shall have pertinent data logged by the Contractor at the time of testing. Data shall include date, time, personnel performing, observing and inspecting, description of the test and extent of system tested, test conditions, test results, specified results an other pertinent data. Data shall be delivered to the Architect/Engineer as specified under “Requirements for Final Acceptance.” The Contractor or Contractor’s authorized job superintendent shall legibly sign all Test Log entries.

3.4 PIPING SYSTEMS - COMMON REQUIREMENTS

A. General: Install HVAC piping as described below, unless piping Sections specifies otherwise. Individual Division 21, 22 and 23 piping Sections specifies unique piping installation requirements.

B. General Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, unless deviations to layout are approved on Coordination Drawings as required by Division 01 Sections and as outlined in Part 1 of this section.

C. Install piping at indicated slope.

D. Install components with pressure rating equal to or greater than system operating pressure.

E. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.

F. Install piping free of sags and bends.

G. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.

H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

I. Install piping to allow application of insulation plus 1-inch clearance around insulation.

J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

K. Install fittings for changes in direction and branch connections.

L. Install couplings according to manufacturer’s written instructions.

M. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:

1. Chrome-Plated Piping: Cast brass, one piece, with set screw, and polished chrome-plated finish.
2. Uninsulated Piping Wall Escutcheons: Cast brass or stamped steel, with set screw.
3. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
4. Insulated Piping: Cast brass with concealed hinge, set screws, and chrome-plated finish.
5. Piping in Utility Areas: Cast brass or stamped steel, with set-screw or spring clips.

N. Install sleeves for pipes passing through concrete and masonry walls, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.
   a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping rings where required.

2. Build sleeves into walls and slabs as work progresses.
3. Install sleeves large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
   a. Steel Pipe Sleeves: For pipes smaller than 6-inch NPS (DN150).
   b. Steel, Sheet-Metal Sleeves: For pipes 6-inch NPS (DN150) and larger, penetrating gypsum-board partitions.

4. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
   a. Seal space outside of sleeve fittings with non-shrink, nonmetallic grout.

5. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealant. Refer to Section 07 92 00 “Joint Sealants” for materials.

6. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.

O. Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
   1. Install steel pipe for sleeves smaller than 6 inches in diameter.
   2. Install cast-iron “wall pipes” for sleeves 6 inches in diameter and larger.
   3. Assemble and install mechanical sleeve seals according to manufacturer’s written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

   1. Assemble and install mechanical sleeve seals according to manufacturer’s written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

Q. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire stopping materials.

R. Verify final equipment locations for roughing-in.

S. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

T. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:
   1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
   2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
   3. Soldered Joints: Construct joints according to CDA’s “Copper Tube Handbook.”
   5. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
      a. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
      b. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
      c. Align threads at point of assembly.
      d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
e. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.


7. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.

8. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join pipe and fittings according to the following:
   a. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
   b. CPVC Piping: ASTM D2846 and ASTM F493.
   c. PVC Pressure Piping: ASTM D2672.
   d. PVC Non-pressure Piping: ASTM D2855.

   a. Plain-End Pipe and Fittings: Use butt fusion.
   b. Plain-End Pipe and Socket Fittings: Use socket fusion.

U. Piping Connections: Make connections according to the following, unless otherwise indicated:
   1. Install unions, in piping 2-inch NPS (DN50) and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS (DN50) or smaller threaded pipe connection.
   2. Install flanges, in piping 2-1/2-inch NPS (DN65) and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
   3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to provide maximum possible headroom, if mounting heights is not indicated.

B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Owner's Representative.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

D. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

E. Install equipment giving right of way to piping installed at required slope as specified in other Division 22 sections.

F. Clearance from Electrical Equipment: Piping is prohibited in electric rooms and closets, elevator machine rooms and installation over transformers, switchboards and motor control centers.
3.6 CONCRETE BASES
   A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit. Follow supported equipment manufacturer’s setting templates for anchor bolt and tie locations. Use 3000-psig 28-day compressive-strength concrete and reinforcement as specified in Section 03 30 00 - “Cast-in-Place Concrete.”

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGE
   A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
   B. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

3.8 ERECTION OF WOOD SUPPORTS AND ANCHORAGE
   A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical materials and equipment.
   B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
   C. Attach to substrates as required to support applied loads.

3.9 CUTTING AND PATCHING
   A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.
   B. Repair cut surfaces to match adjacent surfaces.
   C. Refer to Division 01 Sections for additional requirements.

3.10 GROUTING
   A. Install nonmetallic, non-shrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions. Conform with AEGB BR7 Low Emitting Materials – Interior Paints and Coatings requirements.
   B. Clean surfaces that will come into contact with grout.
   C. Provide forms as required for placement of grout.
   D. Avoid air entrapment during placing of grout.
   E. Place grout, completely filling equipment bases.
   F. Place grout on concrete bases to provide smooth bearing surface for equipment.
   G. Place grout around anchors.
   H. Cure placed grout according to manufacturer's written instructions.

3.11 TRAINING
   A. Operating and Maintenance Manuals and instruction shall be provided as specified under the Division 01 Section entitled “Project Closeout Procedures.”
   B. Specific training and operating instructions for individual equipment components shall be as specified in the individual Specification Sections.
C. All equipment, piping, conduit, ductwork, grilles, insulation, etc., furnished and installed in exposed areas shall be cleaned, prepared and painted as specified in Division 09. Conform with AEGB BR7 Low Emitting Materials – Interior Paints and Coatings requirements.

D. END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
   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. Perform all Work required to provide and install supports, hangers, anchors, sleeves and bases for all pipe, duct, equipment, system components and accessories, indicated by the Contract Documents with all supplementary items necessary for complete, code compliant and approved installation

1.3 REFERENCE STANDARDS
   A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
   B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
   C. All materials, installation and Workmanship shall comply with the applicable requirements and standards addressed within the following references:
      1. Uniform Mechanical Code.
      4. ASME B31.2 - Fuel Gas Piping.
      5. ASME B31.9 - Building Services Piping.
      6. ASTM F708 - Design and Installation of Rigid Pipe Hangers.
      7. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
      8. MSS SP69 - Pipe Hangers and Supports - Selection and Application.
      9. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
     10. MSS SP-90 - Guidelines on Terminology for Pipe Hangers and Supports.
     12. NFPA 14 - Installation of Standpipe and Hose Systems.
     14. SMACNA - HVAC Duct Construction Standards.
15. Underwriters Laboratories Standards and Listings.


1.4 QUALITY ASSURANCE

A. Materials and application of pipe hangers and supports shall be in accordance with MSS-SP-58 and SP-69 unless noted otherwise.

B. Support and sleeve materials and installation shall not interfere with the proper functioning of equipment.

C. Contractor shall be responsible for structural integrity of all hangers, supports, anchors, guides, inserts and sleeves. All structural hanging materials shall have a minimum safety factor of five.

D. Installer Qualifications: Utilize an installer experienced in performing Work of this Section who is experienced in installation of Work similar to that required for this Project and per the minimum requirements of MSS SP-89. Field welding of supports shall be by certified welders qualified in accordance with ASME Boiler and Pressure Vessel Code, Section IX using welding procedures per the minimum requirements of MSS SP-58.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer’s catalog data including code compliance, load capacity, and intended application.

B. AEGB Submittal:

1. Product data complying with Basic Requirements 7 - Low Emitting Materials – Interior Paints and Coatings

C. Manufacturer’s Installation Instructions: Indicate special procedures and assembly of components.

D. Shop Drawings: Submit detailed Drawings of all shop or field fabricated supports, anchors and sleeves, signed and sealed by a qualified State of Texas registered professional engineer. Indicate size and characteristics of components and fabrication details and all loads exceeding 250 pounds imposed on the base building structure.

1.6 DELIVERY, STORAGE AND HANDLING

A. Comply with manufacturer’s ordering instructions and lead time requirements to avoid construction delays.

B. Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact. Maintain in place until installation.

C. Store materials protected from exposure to harmful weather conditions.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
2.2 MANUFACTURERS
   A. Hangers and Supports:
      1. Anvil International.
      2. Kinder.
      3. Cooper B-Line.
      5. Hubbard Enterprises/Holdrite
      7. Power Strut.

2.3 HANGERS AND SUPPORTS
   A. General:
      1. Refer to individual system and equipment Specification Sections for additional support requirements. Comply with MSS SP-69 for support selections and applications that are not addressed within these Specifications.
      2. Utilize hangers and supports to support systems under all conditions of operation, allowing free expansion and contraction, and to prevent excessive stresses from being introduced into the structure, piping or connected equipment.
      3. All pipe supports shall be of the type and arrangement to prevent excessive deflection, to avoid excessive bending stresses between supports, and to eliminate transmission of vibration.
      4. Design hangers to impede disengagement by movement of supported pipe.
      5. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping.
      6. Wire or perforated strap iron will not be acceptable as hanger material.
      7. Hanger rods shall be threaded on both ends, threaded one end, or continuous threaded, complete with adjusting and lock nuts.
      8. Fasteners requiring explosive powder (shooting) or pneumatic-driven actuation will not be acceptable under any circumstances.
      9. Plastic anchors or plastic expansion shields will not be permitted under any circumstances.
     10. Hangers and clamps supporting and contacting individual non-insulated brass or copper lines shall be copper or copper plated. Where non-insulated brass or copper lines are supported on trapeze hangers or channels, the pipes shall be isolated from these supports with approved flexible elastomeric/thermoplastic isolation cushion material to completely encircle the piping and avoid contact with the channel or clamp. Plastic tape is not acceptable.
11. Hangers and clamps supporting and contacting glass piping shall be in accordance with the piping manufacturer’s published recommendations and shall be fully lined with minimum 1/4 inch neoprene padding. The padding material and the configuration of its installation shall be submitted for approval.

12. Hangers and clamps supporting and contacting plastic piping shall be in accordance with the piping manufacturer’s published recommendations and shall be factory coated or padded to prevent damage to piping.

13. Field fabricated supports shall be constructed from ASTM A36/A36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.

B. Finishes: All ferrous hangers, rods, inserts, clamps, stanchions, and brackets on piping within interior non-corrosive environments, shall be dipped in Zinc Chromate Primer before installation. Rods may be galvanized or cadmium plated after threading, in lieu of dipping zinc chromate. All hangers and supports exposed to the weather, including roofs and building crawl space areas, shall be galvanized or manufactured from materials that will not rust or corrode due to moisture. All hangers and supports located within corrosive environments shall be constructed from or coated with materials manufactured for installation within the particular environment. Conform with AEGB BR7 Low Emitting Materials – Interior Paints and Coatings requirements.

C. Vertical Piping: Supports for vertical riser piping in concealed areas shall utilize double bolt riser clamps, with each end having equal bearing on the building structure at each floor level. Two-hole rigid pipe clamps or four-hole socket clamps with washers may be used to support pipe directly from adequate structural members where floor-to-floor distance exceeds required vertical support spacing and lines are not subject to expansion and contraction. Supports for vertical riser piping at floor levels in exposed areas (such as fire protection standpipe in stairwells) shall be attached to the underside of the penetrated structure utilizing drilled anchors, two hanger rods (sized as specified), and socket clamp with washers.

D. Trapezes: Where multiple lines are run horizontally at the same elevation and grade, they may be supported on manufactured channel, suspended on rods or pipes. Trapeze members including suspension rods shall be properly sized for the quantity, diameters, and loaded weight of the lines they are to support.

E. Ductwork: All ductwork shall be supported in accordance with SMACNA recommendations for the service involved. Horizontal ducts supported using galvanized steel bands shall extend up both sides and onto the construction above, where they shall turn over and be secured with bolts and nuts fitted in inserts set in the concrete, bolted to angles secured to the construction above, or secured in another approved manner.

F. Terminal Units:

1. Terminal units weighing up to 150 pounds shall be supported by four (4) 1 inch wide sheet metal straps with ends turned under bottom of unit at corners.

2. Each band shall be secured by not over 3/4 inch in length, 1/4 inch diameter sheet metal screws – two (2) on bottom of unit and one (1) on each side.

3. The other strap end shall be attached to the structure by 1/4 inch diameter threaded bolt into the concrete insert or into drilled-hole threaded concrete expansion anchor.

4. Where interference occurs, overhead of the box, not allowing direct vertical support by straps, provide trapeze channels suspended by 1/4 inch diameter galvanized threaded rods providing such channels do not block access panels of units.

5. Terminal units weighing more than 150 pounds shall be supported per the terminal unit manufacturer’s installation instructions using threaded rod and hanger brackets located per manufacturer’s drawing.
G. Fixture and Equipment Service Piping:

1. Piping at local connections to plumbing fixtures and equipment shall be supported to prevent the weight of the piping from being transmitted to fixtures and equipment.

2. Makeshift, field-devised methods of plumbing pipe support, such as with the use of scrap framing materials, are not allowed. Support and positioning of piping shall be by means of engineered methods that comply with IAPMO PS 42-96. These shall be Hubbard Enterprises/Holdrite support systems, C & S Mfg. Corp. or Owner-approved equivalent.

3. Supports within chases and partitions shall be corrosion resistant metal plate, clamps, angles or channels, and aligned with structure in the vertical or horizontal position. Plastic supports are not allowed unless approved by Owner.

4. Horizontal supports within chases and partitions that are attached to studs shall be attached at both ends. Drywall shall not be relied upon to support the piping.

5. Supports for plumbing fixture water service piping within chases and partitions may be attached to cast iron drain and vent pipe with approved brackets and pipe clamps.

6. Piping exposed on the face of drywall shall be supported with corrosion resistant metal channels that are attached to wall studs. Drywall shall not be relied upon to support the piping.

7. Piping supported from the floor shall utilize corrosion resistant metal channels or brackets that are anchored to the floor slab.

8. All water piping shall be isolated from building components to prevent the transmission of sound.

9. All copper or brass lines shall be isolated from ferrous metals with dielectric materials to prevent electrolytic action. Plastic tape is not an acceptable isolation material.

H. Fire Protection Piping: All hangers and supports for fire standpipe systems and fire sprinkler systems shall be Factory Mutual and Underwriters' Laboratories, Inc. listed and labeled.

I. Inserts:


2. Inserts shall have malleable iron case with galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods. Suitable concrete inserts for pipe and equipment hangers shall be set and properly located for all pipe and equipment to be suspended from concrete construction. If the inserts are later found not to be in the proper location for the placement of hangers, then drilled anchors shall be installed. Drilled anchors in concrete or masonry shall be submitted for the approval.

3. Manufactured inserts for metal deck construction shall have legs custom fit to rest in form valleys.

4. Shop fabricated inserts shall be submitted and approved by Owner prior to installation.

5. Inserts shall be of a type that will not interfere with structural reinforcing and that will not displace excessive amounts of structural concrete.
J. Pipe Shields: Provide pipe shields in accordance with insulation manufacturer’s published recommendations. Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier.

K. Housekeeping Pads:
   1. Provide minimum 4 inch reinforced concrete pads with chamfered corners and equipment bases for all outdoor equipment on grade, floor mounted equipment in main central plant area, mechanical rooms, areas with floors below grade, penthouse equipment rooms, floor mounted air handling units, and where shown on Drawings.
   2. Housekeeping pads shall extend minimum of 4 inch on all sides beyond the limits of the mounted equipment unless otherwise noted.
   3. Provide galvanized anchor bolts for all equipment placed on concrete pads or on concrete slabs of the size and number recommended by the equipment manufacturer.

2.4 PIPE AND DUCT PENETRATIONS

A. General:
   1. Seal penetrations through all rated partitions, walls and floors with U.L. tested assemblies to provide and maintain a rating equal to or greater than the partition, wall or floor.
   2. Inside diameter of all sleeves or cored holes shall provide sufficient annular space between outside diameter of pipe, duct or insulation to allow proper installation of required fire and water proofing materials and allow for movement due to expansion and contraction.
   3. Exposed ceiling, floor and wall pipe penetrations within finished areas (including exterior wall faces) shall be provided with chrome plated, brass or stamped steel, hinged, split-ring escutcheon with set screw or snap-on type. Inside diameter shall closely fit pipe outside diameter or outside of pipe insulation where pipe is insulated. Outside diameter shall completely cover the opening in floors, walls, or ceilings. In exterior, damp, or corrosive environments, use Type 302 stainless steel escutcheons.

B. Floor Pipe Penetrations:
   1. Seal penetrations through all floors to provide and maintain a watertight installation.
   2. Sleeves cast in the slab for pipe penetrations shall be Schedule 40 steel, ASTM A53, with 2 inch wide annular fin water-stop continuously welded at midpoint. Entire assembly shall be hot-dipped galvanized after fabrication. Water-stop shall be same thickness as sleeve.
   3. Cored holes in the slab for pipe penetrations shall be provided with a Schedule 40 steel, ASTM A53, sleeve with 2 inch wide annular fin water-stop continuously welded at point on sleeve to allow countersinking into slab and waterproofing. Entire sleeve assembly shall be hot-dipped galvanized after fabrication. Water-stop shall be same thickness as sleeve.
   4. All sleeves shall extend a minimum of two inches above finished floor.
5. Where job conditions prevent the use of a sleeve that extends two inches above the slab, Link- Seal mechanical casing seals manufactured by Thunderline Corporation may be installed to provide a watertight penetration. Mechanical casing seals can be used only for relatively small diameter pipe penetrations. Verify that slab thickness allows proper installation of the link-seal assembly and the required fire stopping prior to applying this exception.

C. Wall Penetrations:

1. Where piping or ductwork passes through non-rated partition, close off space between pipe or duct and construction with gypsum wallboard and repair plaster smoothed and finished to match adjacent wall area.

2. Pipe penetrations through interior rated partitions shall be provided with adjustable prefabricated U.L. listed fire rated galvanized sheet metal sleeves having gauge thickness as required by wall fire rating, 20 gauge minimum.

3. Pipe penetrations through exterior walls and walls below grade shall be provided with “Link-Seal” mechanical casing seal manufactured by Thunderline Corporation.

4. Ductwork penetrations through rated partitions, walls and floors shall be provided with sleeves that are manufactured integral with the damper assembly installed.

D. Flashing:

1. Coordinate flashing material and installation required for pipe and duct roof penetrations with Owner and roofing Contractor.

2. Provide flexible flashing and metal counter-flashing where ductwork penetrates exterior walls. Seal penetration water and air tight.

3. Provide acoustical flashing around ducts and pipes penetrating equipment rooms, with materials and installation in accordance with manufacturer’s instructions for sound control.

E. Roof Curbs: Coordinate roof curb material and installation with Owner and roofing Contractor.

PART 3 - EXECUTION

3.1 PREPARATION

A. Conduct a pre-installation meeting prior to commencing Work of this Section to verify Project requirements, coordinate with other trades, establish condition and completeness of substrate, review manufacturer’s installation instructions and manufacturer’s warranty requirements.

3.2 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. Application, sizing and installation of piping, supports, anchors and sleeves shall be in accordance with manufacturer’s printed installation instructions.

C. Provide for vertical adjustments after erection and during commissioning, where feasible, to ensure pipe is at design elevation and slope.

D. Install hangers and supports to allow controlled thermal movement of piping systems, permitting freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
E. Install hanger so that rod is vertical under operating conditions.

F. Supports, hangers, anchors, and guides shall be fastened to the structure only at such points where the structure is capable of restraining the forces in the piping system.

G. The load and spacing on each hanger and/or insert shall not exceed the safe allowable load for any component of the support system, including the concrete that holds the inserts. Reinforcement at inserts shall be provided as required to develop the strength required. Contractor shall be responsible for engaging a structural engineer as required for design and review at support systems.

H. Do not hang pipe, duct or any mechanical/plumbing item directly from a metal deck or locate on the bottom chord of any truss or joist unless approved by the Structural Engineer of Record.

I. All supports shall be designed and installed to avoid interference with other piping, hangers, ducts, electrical conduit, supports, building structures, equipment, etc.

J. Piping supports shall be independent from ductwork supports. Combining supports is not permitted.

K. Provide all supporting steel required for the installation of mechanical equipment and materials, including angles, channels, beams, etc. to suspended or floor supported tanks and equipment. All of this steel may not be specifically indicated on the Drawings.

L. All piping and ductwork supports shall be designed and installed to allow the insulation to be continuous through the hangers.

M. Adjustable clevis hangers shall be supported at rods with a nut above and below the hanger.

N. All hanger rods shall be trimmed neatly so that 1 inch of excess hanger rod protrudes beyond the hanger nut. In the event a rod is intentionally but temporarily left excessively long (for sloped or insulated lines for example), the Contractor shall take appropriate measures to protect the pipe or other materials from damage.

O. Install hangers to provide minimum ½ inch space between finished covering and adjacent structures, materials, etc.

P. Horizontal and vertical piping in chases and partitions shall be supported to prevent movement and isolated from the supports to prevent transmission of sound.

Q. Locate hangers within 12 inches of each horizontal elbow.

R. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

S. Support riser piping independently of connected horizontal piping. Riser piping is defined as vertical piping extending through more than one floor level.

T. Support vertical piping with clamps secured to the piping and resting on the building structure or secured to the building structure below at each floor. Use method of securing the vertical risers to the building structure below in stairwells and exposed locations. Installation of riser clamps and welded steel riser supports shall not allow weight of piping to be transmitted to floor sleeves. Exception: Schedule 40 steel floor sleeves with continuously welded 2 inch minimum water-stop ring.

U. Steel Bar Joists: Hanger rods shall be secured to angle irons of adequate size; each angle shall span across two or more joists as required to distribute the weight properly and shall be welded or otherwise permanently fixed to the top of joists.
V. Steel Beams: Where pipes and loads are supported under steel beams, approved type beam clamps shall be used.

W. Pre-Cast Tee Structural Concrete: Hanger supports, anchors, etc. attached to the precast, double tee, structural concrete system shall be installed in accordance with approved Shop Drawings only. Holes required for hanger rods shall be core drilled in the "flange" of the double tee only; impact type tools are not allowed under any circumstances. Core drilling in the "stem" portions of the double tee is not allowed. Holes core drilled through the "flange" for hanger rods shall be no greater than 1/4 inch larger than the diameter of the hanger rod. Hanger rods shall be supported by means of bearing plates of size and shape acceptable to the Architect/Engineer, with welded double nuts on the hanger rod above the bearing plate. Cinch anchors, lead shields, expansion bolts, and studs driven by explosion charges are not allowed under any circumstances in the lower 15 inches of each stem and in the "shadow" of the stem on the top side of the "double tees".

X. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

Y. Inserts:
   1. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   2. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
   3. Install anchors in concrete after concrete is placed and completely cured. Install anchors according to manufacturer's written instructions.

Z. Flashing:
   1. Coordinate all roof flashing with requirements of Division 07.

AA. Pipe Shields:
   1. Provide shields at each hanger supporting insulated pipe.
   2. Provide shields of the proper length to distribute weight evenly and to prevent compression of insulation at hanger.
   3. Install shield so that hanger is located at the center of the shield.
   4. Attach shield to insulation with adhesive to prevent slippage or movement.

BB. Equipment Anchor Bolts:
   1. Foundation bolts shall be placed in the forms when the concrete is poured, the bolts being correctly located by means of templates. Each bolt shall be set in a sleeve of sufficient size to provide ½ inch clearance around bolt.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
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. Perform all Work required to provide and install inertia bases and vibration isolation indicated by the Contract Documents with supplementary items necessary for their proper installation.

1.3 REFERENCE STANDARDS
A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
C. All materials, installation and Workmanship shall comply with the applicable requirements and standards addressed within the following references:
   1. ASHRAE - Guide to Average Noise Criteria Curves.
   2. Austin Energy Green Building Program (AEGB) Basic Requirements 7 - Low Emitting Materials – Interior Paints and Coatings

1.4 QUALITY ASSURANCE
A. Provide for vibration isolation supports for all equipment, piping and ductwork indicated herein. The transmission of perceptible vibration, structural borne noise or objectionable air borne noise to occupied areas by equipment installed under this Contract will not be permitted. Install vibration isolators as specified herein or shown on the Drawings or otherwise required to prevent the transmission of vibration which would create objectionable noise levels in occupied areas.
B. The vibration isolation supplier must be a firm capable of dealing effectively with vibration and noise characteristics effects and criteria; and one that can provide facilities and capabilities for measuring and evaluating the aforementioned disturbances.
C. Maintain ASHRAE criteria for average noise criteria curves for all equipment at full load condition.
D. Provide vibration isolation devices, from a single manufacturer or supplier who will be responsible for complete coordination of all phases of this Work.

1.5 SUBMITTALS
A. Product Data:
   1. Submit Shop Drawings, installation instructions, and product data.
   2. Indicate vibration isolator locations, with static and dynamic load on each, on Shop Drawings and described on product data.
   3. Contractor shall furnish complete submittal data, including Shop Drawings, which shall indicate the size, type and deflection of each isolator; and the supported weight, disturbing frequency and efficiency of each isolator proposed; and any calculations and other information as may be required for the Architect/Engineer to check the isolator selection for compliance with the specification.
B. Record Documents:
   1. Indicate inertia bases on Shop Drawings, including dimensions.
2. All steel bases and concrete inertia bases shall be completely detailed, and shall show completely any reinforcing steel that may be required to provide a rigid base for the isolated equipment. Further, the submittal data shall clearly indicate outlined procedures for installing and adjusting the isolators and bases mentioned above.

3. Submittals on riser isolation system shall show initial and final loads on the structure at each support point, initial and final deflection of each isolator, amount and direction of each deflection change, total expansion and contraction of each riser and operating temperature of 180 degrees F in the riser.

4. Riser diagrams shall be prepared by the vibration isolation manufacturer and submitted for approval. These diagrams shall show initial and final spring deflections, amount and direction of deflection changes, overall expansion and contraction of the riser, and operating temperature of the medium.

5. Submittal data shall include certification that the riser system has been examined for excessive stresses and that none will exist in the design proposed when installed in accordance with submittal and these Specifications.

C. Operation and Maintenance Data:
1. Provide manufacturer's recommended maintenance procedures.

PART 2 - PRODUCTS

2.1 GENERAL
A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
B. All vibration isolators and bases shall be designed for and treated for resistance to corrosion.
C. Steel components shall be PVC coated or phosphated and painted with industrial grade enamel. All nuts, bolts and washers shall be zinc-electroplated or cadmium plated. Conform with AEGB BR7 Low Emitting Materials – Interior Paints and Coatings requirements.
D. All isolators exposed to the weather shall have steel parts hot-dip galvanized or zinc-electroplated plus coating of Neoprene or Bitumastic paint. Aluminum components for outdoor installation shall be etched and painted with industrial grade enamel.
E. Required spring deflections for isolators supporting various items of equipment are shown on the Drawings or tabulated elsewhere in these Specifications, but in no case shall be less than one inch. Springs shall be capable of 30 percent over-travel before becoming solid.
F. Where height-saving brackets for side mounting of isolators are required, the height-saving brackets shall be designed to provide for an operating clearance of 2 inches under the isolated structure and designed so that the isolators can be installed and removed when the operating clearance is 2 inches or less. When used with spring isolators having a deflection of 2-1/2 inches or more, the height-saving brackets shall be of the pre-compression type to limit exposed bolt length between the top of the isolator and the underneath side of the bracket.
G. All isolators supporting a given piece of equipment shall limit the length of the exposed adjustment bolt between the top and base to a maximum range of 1 inch to 2 inches.
H. All isolators supporting a given piece of equipment shall be selected for approximately equal spring deflection.
I. Isolators for equipment installed outdoors shall be designed to provide adequate restraint due to normal wind conditions and to withstand wind load of 55 pounds per square foot applied to any exposed surface of the equipment without failure.

2.2 MANUFACTURERS
A. Amber Booth.
B. Korfund Dynamics.
C. Consolidated Kinetics.
D. Mason Industries.
2.3 ISOLATION BASES

A. Type SFB: A structural steel fan and motor base with NEMA standard motor side rails and holes drilled to receive the fan and motor. The steel members shall be adequately sized to prevent distortion and misalignment of the drive.

B. Type CPF: Concrete inertia base, consisting of full depth perimeter steel pouring form, 3000 psi concrete reinforcing bars welded in place, bolting templates with anchor bolts and height-saving brackets for side mounting of the isolators. The base shall be sized with a minimum overlap of 4 inches around the base of the equipment. Fan bases are to be supplied with NEMA standard motor side rails.

C. The bases for pumps shall be sized to support the suction elbow of end suction pumps and both the suction and discharge elbows of horizontal split-case pumps. The bases shall be T-shaped where necessary to conserve space.

D. Structural bases shall be thoroughly cleaned of welding slag and primed with zinc-chromate or metal etching primer. A finish coat of industrial grade enamel shall be applied over the primer.

2.4 ISOLATOR TYPES

A. Isolator types and required deflections are specified under “Application.” Isolator type designations are Amber Booth designators. The isolators shall comply with the following descriptions for each type required on the Project:

1. Type XL: Aluminum-housed, adjustable, spring mounting having telescoping top and bottom sections separated by resilient inserts of Neoprene or other suitable material to limit horizontal motion. The inserts shall be permanently lubricated to minimize vertical friction. Steel or cast iron housings may be used if they are hot-dip galvanized after fabrication. A Neoprene pad having a minimum thickness of ¼ inch shall be bonded to the baseplate.

2. Type SW: Adjustable, freestanding, open-spring mounting with combination leveling bolt and equipment fastening bolt. The spring mounting to baseplate and compression plate must be rigid. The neoprene pad with a minimum thickness of ¼ inch is bonded to the baseplate. A minimum horizontal-to-vertical spring rate of 1.0 is required.

3. Type BS: Spring hanger consisting of a rectangular steel box, coil spring, spring retainers, neoprene-impregnated fabric washer and steel washer.

4. Type BSA: Spring hanger consisting of a rectangular steel box capable of 200 percent minimum overload without visible deformation, coil spring, spring retainers, neoprene impregnated fabric washer and steel washer. Incorporate a 30 degree angularity feature that will permit up to a 15 degree misalignment of the hanger rod from the vertical without shorting out to the hanger box.

5. Type BSR: Combination spring and rubber hanger consisting of a rectangular steel box, coil spring, spring retainers and elastomeric mounting designed for ½ inch deflection.

6. Type BSRA: Combination spring and elastomeric hanger consisting of a rectangular steel box capable of 200 percent minimum overload without visible deformation, coil spring, spring retainers and elastomeric element. Incorporate a 30 degree angularity feature that will permit up to a 15 degree misalignment of the hanger rod from the vertical without shorting out to the hanger box.

7. Type RSW: Adjustable spring isolator as describe for Type SW with the addition of a fabricated steel housing suitable for recessing into a concrete inertia block. The housing has a side access.

8. Type PBS: Spring hanger as described for Type BS with the addition of a load transfer plate to hold the equipment or piping at a fixed elevation during installation and to permit transferring the load to the spring after installation.
9. Type PBSA: Spring hanger consisting of a rectangular steel box capable of 200 percent minimum overload without visible deformation, with the addition of a load transfer plate to hold the equipment or piping at a fixed elevation during installation, and to permit transferring the load to the spring after installation, a coil spring, spring retainers, neoprene impregnated fabric washer and steel washer. Incorporate a 30 degree angularity feature that will permit up to a 15 degree misalignment of the hanger rod from the vertical without shorting out to the hanger box.

10. PBSR: Combination spring and elastomeric hanger as described for Type BSR with the addition of a load transfer plate to hold the equipment or piping at a fixed elevation during installation and to permit transferring the load to the spring after installation.

11. Type PBSRA: Combination spring and elastomeric hanger consisting of a rectangular steel box capable of 200 percent minimum overload without visible deformation, with the addition of a load transfer plate to hold the equipment or piping at a fixed elevation during installation, a coil spring, spring retainers and elastomeric element. Incorporate a 30 degree angularity feature that will permit up to a 15 degree misalignment of the hanger rod from the vertical without shorting out to the hanger box.

12. Type CT: Adjustable, open-spring isolator having one or more coil springs attached to a top compression plate and a base plate. A neoprene pad with a minimum thickness of ¼ inch is bonded to the base plate. The spring assembly must fit within a welded steel enclosure consisting of a top plate and rigid lower housing, which serves as a blocking device during installation. The isolator includes restraining bolts for connecting the top plate and lower housing to prevent the isolated equipment from rising when drained of water.

13. Type SP-NRE: Pad-type mounting consisting of two layers of 3/8 inch thick ribbed or waffled neoprene pads bonded to a 16 gauge galvanized steel separator plate. Size pads for approximately 20 to 40 psi load and a deflection of 0.12 to 0.16 inch.

14. Type BRD: Elastomeric hanger consisting of a rectangular steel box and an elastomeric isolation element of neoprene. A high-quality synthetic rubber may be used if it contains antiozone and antioxidant additives. The elements are designed for approximately ½ inch deflection and loaded so that the deflection does not exceed 15 percent of the free height of the element.

15. Type TRK: For static pressure of 3 inch water or greater, provide a set of spring-loaded thrust resistors (two or more) installed across the flexible duct connection on the fan discharge, designed to limit the movement of the fan. Coil spring static deflection capabilities of thrust resistors shall equal those of the isolators supporting the equipment up to a maximum of 2 inches.

16. Type RVD: An elastomeric mounting having a steel baseplate with mounting holes and a threaded insert at top of the mounting for attaching equipment. All metal parts shall be completely embedded in the elastomeric material. Mountings shall be designed for approximately ½ inch deflection.

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 installation shall be in accordance with manufacturer’s published recommendations.

C. Install motor driven equipment with vibration isolators.

D. Set steel bases for one-inch clearance between housekeeping pad and base. Set concrete inertia bases for 2 inch clearance. Adjust equipment level.

E. Isolate pumped water-piping systems with spring-type vibration isolators to produce a floating mechanical system. Provide spring isolators on piping connected to isolated equipment as follows: Static deflection for the two supports closest to equipment on each pipe connected to the equipment shall be equal to the deflection of isolated equipment. All other supports for horizontal piping shall have a minimum operating deflection of ¾ inch with a capability of an additional 50 percent travel to solid.
F. All open-type spring isolators shall be restrained as recommended by the manufacturer.

G. Pumps:
   1. Each centrifugal pump and its driving motor shall be mounted on a common inertia base and the base, in turn, shall be mounted on the scheduled vibration isolator type to prevent transmission of vibration and noise to the building structure.
   2. In general, all inertia bases shall be formed and poured in place onto a hard, flat surface from which the base can be separated when cured. The base shall be shimmed, using flat material, to the intended final height prior to equipment mounting and piping connection.
   3. After piping connections are made and the system filled with water and ready to put into service, the isolator adjustment bolts shall be extended until the shim blocks can be removed. Isolators may then be backed down slightly to restore the intended height. The locknuts should then be tightened on the isolators. Jack bolts shall be trimmed to a length that will allow no more than 1 inch of additional height adjustment. After final adjustment, the inertia base shall not support any piping load. All springs supporting piping that is connected to a piece of isolated equipment shall be sized for static deflection equal to that of the isolated equipment.

H. Piping:
   1. Floor mounted supports shall have the same type of isolator or media as is used for the nearest isolated equipment connected to the piping.
   2. The pipe hanger system shall have provisions for all piping to be shimmed or blocked in place until all connections are made and the system filled with water; then, the isolators adjusted to support the weights and the shim blocks removed.
   3. The first three support points from a piece of isolated equipment shall be of the positioning type and provide not less than the static deflection of the equipment isolators.
   4. All springs supporting piping shall be capable of an additional ½ inch deflection prior to complete compression and springs supporting vertical risers shall have provisions for limit stops.
   5. Support risers up through 16 inches at every third floor, and risers 18 inches and over at every second floor. All supports for risers must have a deflection capability at least four times the anticipated expansion and contraction. Install temporary anchors as required to permit preadjustment of springs in the risers. Furnish permanent limit stops to prevent excessive vertical motion of risers in the event risers are drained. Wall sleeves for takeoffs from risers shall be sized for insulation outside diameter plus two times the calculated thermal movement to prevent binding.
   6. System operating temperatures (degrees F) are as follows:

<table>
<thead>
<tr>
<th>Service</th>
<th>Supply</th>
<th>Return</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chilled Water</td>
<td>42</td>
<td>54</td>
</tr>
<tr>
<td>Heating Water</td>
<td>160</td>
<td>140</td>
</tr>
</tbody>
</table>

I. Resilient Sleeves: Resilient sleeves shall be provided at all points where equipment room walls, floors or ceilings are penetrated by ducts, piping or refrigerant line, etc.

J. Fans and Air Handling Units: Such units shall have electrical flexible connections not less than 36 inches long and the flexible duct connections with a free length of not less than 8 inches.

K. Ductwork: Isolate all high pressure ductwork within each equipment room and to a minimum of 50 feet from fan with Type BS hangers or Type SW floor supports, sized for ¾ inch deflection.
L. To prevent excessive transfer of piping load from floor to floor, all water riser support springs shall have a deflection capability of four times the expansion or contraction to be accommodated by the support with the additional runout capability to absorb the movement. Isolators supporting steam and diesel engine exhaust risers shall be selected for deflections equal to two times the anticipated thermal movement at the support point. Riser isolation system shall be designed such that it supports the riser in tension, eliminating the need for guides; requires no anchors; and has a zero movement point at or near the center to divide thermal movement approximately in half, thus reducing vertical movement of horizontal pipe takeoffs.

3.2 APPLICATION

A. The following is a schedule of equipment on a typical project that requires vibration isolation and base isolators of the types specified. Refer to Drawings for equipment scheduled for the Project. Any equipment, system or condition that may be altered, added, or changed; or that is not specifically described in the Contract Documents shall be isolated in a manner specified for similar equipment, system or condition in order to comply with these Specifications. No external isolation is required if the equipment is internally isolated static or dynamically.

<table>
<thead>
<tr>
<th>Equipment Type</th>
<th>Isolator Type/ Minimum Deflection (Inches)</th>
<th>Base Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Handling Units</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Floor Mounted – Up to 15 HP</td>
<td>SW 2”</td>
<td>N/A</td>
</tr>
<tr>
<td>Floor Mounted – 15 HP and Over</td>
<td>SW2.4”</td>
<td>N/A</td>
</tr>
<tr>
<td>Suspended – Up to 15 HP</td>
<td>PBSRA 2”</td>
<td>SFB</td>
</tr>
<tr>
<td>Suspended – 15 HP and Over</td>
<td>PBSRA 3.5”</td>
<td>SFB</td>
</tr>
<tr>
<td>High pressure Fan Sections</td>
<td>SW 2” with TRK 3.5</td>
<td>CPF</td>
</tr>
<tr>
<td>Fan Coil Units – Suspended</td>
<td>PBSRA 1”</td>
<td>N/A</td>
</tr>
<tr>
<td>Fan Powered Terminal Units Not Internally Isolated</td>
<td>PBSRA 1”</td>
<td>N/A</td>
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<tr>
<td>Centrifugal Fans</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class I and II – Up to 54-¼ inch Diameter Up to 15 HP</td>
<td>SW 2”</td>
<td>SFB (If required)</td>
</tr>
<tr>
<td>Class I and II – 60-inch Diameter and Over, 15 HP and Over</td>
<td>SW 4.5”</td>
<td>SFB (If required)</td>
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<tr>
<td>Class III – All sizes</td>
<td>SW 3.5” with TRK 2”</td>
<td>CPF</td>
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<td>Arrangement # 3 Fans</td>
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<td>SFB</td>
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<td>Vent Sets:</td>
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<tr>
<td>Floor Mounted – Up to 15 HP</td>
<td>SW 1.5”</td>
<td>SFB (If required)</td>
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<tr>
<td>Suspended – Up to 15 HP</td>
<td>PBSRA 1.5”</td>
<td>SFB (If required)</td>
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<td>Compressors</td>
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<td>Pumps:</td>
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<tr>
<td>Up to 5 HP</td>
<td>RSW 0.5”</td>
<td>CPF</td>
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<td>5 HP to 10 HP</td>
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<td>CPF</td>
</tr>
<tr>
<td>10 HP and Over</td>
<td>RSW 2”</td>
<td>CPF</td>
</tr>
</tbody>
</table>

B. Piping Application:
1. Type PBSRA for hangers in all horizontal piping at equipment; except at connections to risers use BS.
2. Type SW for all floor supports of floor supported piping at equipment or stanchion.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary
   Conditions and Division 01 Specification Sections, apply to this Section.
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. Perform all Work required to provide and install Owner’s equipment tags, valve tags,
   stencils, and pipe markers indicated by the Contract Documents with supplementary items
   necessary for proper installation.
B. Contractor shall make it possible for Owner’s personnel that will operate and maintain the
   equipment and systems in this Project to readily identify the various pieces of equipment,
   valves, piping, ductwork, etc., by marking them.
C. All items of equipment such as fans, pumps, etc., shall be clearly marked using equipment
   tags as hereinafter specified. The tagged item of equipment shall correspond to the same
   number as shown on the Drawings.

1.3 REFERENCE STANDARDS
A. The latest published edition of a reference shall be applicable to this Project unless identified
   by a specific edition date.
B. All reference amendments adopted prior to the effective date of this Contract shall be
   applicable to this Project.
C. All materials, installation and Workmanship shall comply with the applicable requirements
   and standards addressed within the following references:
   4. Uniform Mechanical Code
   5. Uniform Plumbing Code
   6. Austin Energy Green Building Program (AEGB) Basic Requirements 7 - Low Emitting
      Materials – Interior Paints and Coatings

1.4 SUBMITTALS
A. Product Data:
1. Provide manufacturer’s catalog literature for each product.

B. Record Documents:

1. Submit valve schedule complete with asset number, building number, room number, valve tag numbering system, valve function, valve type, area served, year installed, manufacturer, model number, size, rated pressure, temperature rating and normal position.

C. Operation and Maintenance Data:

1. Manufacturer’s Installation Instructions: Indicate special procedures and installation.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

2.2 MANUFACTURERS

A. Equipment Tags, Valve Tags, Markers, and Tacks:

1. Marking Systems, Inc.
2. Seton Name Plate Company.
4. Graphic Products, Inc.

2.3 EQUIPMENT TAGS

A. Description: 3” x 4” vinyl label, 3.0 Mil self adhesive vinyl similar to DuraLabel Pro. Label color shall be black text on a white background. The label shall contain the following information per the template, described in Attachment “C”:

1. Equipment name: Per Owner’s Equipment Naming convention and as listed in Contractor’s Equipment List/Matrix.
2. Function
3. Area served

B. All scheduled equipment shall be identified with an Equipment Tag.

2.4 VALVE TAGS


B. Valve tags shall be ABS plastic tags: Injected molded ABS plastic, 3.375” X 4.75” with self adhesive vinyl label, similar to DuraLabel Pro, affixed to valve tag. Each tag shall be attached to its valve with one tie strap.

C. Vinyl Label: 3.0 Mil self adhesive vinyl similar to DuraLabel Pro. Label color shall be as per
the standard designated colors listed in the attachment to this specification.

D. In addition to valve tags, valves at water headers and steam PRV stations, valves associated with condensate, gas, water meters, and other valves as specified shall be tagged with standardized color coded plastic tags. Each tag shall be attached to its valve with one tie strap. These tags shall be 2-½ inches wide by 1-½ inches high with these color codings:

1. Red = normally closed.
2. Green = normally open.
3. Blue = open in winter, closed in summer.
4. Yellow = closed in winter, open in summer.

E. Valve Tag Fasteners: Single ABS plastic tie strap.

2.5 PIPE AND DUCT MARKERS

A. Round Pipe and Duct Markers shall conform to ANSI A13.1-2007 "Scheme for the Identification of Piping Systems", refer to Attachment “B” for abbreviation and label color designations. Arrow markers must have same ANSI background colors as their companion pipe markers, or be incorporated into the pipe identification marker.

B. Rectangular Duct Stencils shall conform to ANSI A13.1-2007 "Scheme for the Identification of Piping Systems", refer to Attachment “B” for abbreviation and label color designations. Letter height shall be a minimum of 1-1/4”. Stencil material shall be fiber board; Stencil paint shall be exterior, gloss, acrylic enamel. Conform with AEGB BR7 Low Emitting Materials – Interior Paints and Coatings requirements.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Plastic Tape Pipe Markers: Heat sealed or heat shrink, spring fasteners, clips or snap-on, are acceptable.

E. Underground Plastic Pipe markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

F. Pipe markers and arrow markers also shall be provided for all piping systems.

G. Use Seton Setmark Type SNA or Brady snap-on type identification for all piping systems, up through 6 inch. For piping systems larger than 6 inches, use Seton or Brady strap-on markers or similar by Marking Services, Inc.

2.6 LOCATER TACKS FOR EQUIPMENT LOCATED ABOVE LAY-IN CEILING

A. Description: Steel with ¾-inch diameter color-coded head.

B. Color code as follows:
1. Yellow - HVAC equipment fan-coil units, exhaust fans and terminal units.
2. Red - Fire dampers/smoke dampers.
3. Green - Plumbing valves
4. Blue - Heating/cooling valves

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 installation shall be in accordance with manufacturer's published recommendations.
C. Install plastic tape, and pipe markers completely around pipe in accordance with manufacturer's instructions.
D. Locate markers on the two (2) lower quarters of the pipe where view is unobstructed.
E. Locate tacks on the ceiling grid.

3.2 VALVE TAGS
A. Contractor(s) shall provide and install valve tags on all valves installed within this Project, except check valves; valves within fabricated equipment units; faucets; hose connections; needle valves; gauge cocks; HVAC terminal devices and similar roughing-in connections of end-use fixtures and units.

3.3 APPLICATION OF MARKERS AND STENCILS
A. Piping runs throughout the Project including those above lift-out ceilings, under floor and those exposed to view when access doors or access panels are opened shall be identified by means of pipe markers and/or stencils. Concealed areas, for purposes of this identification section, are those areas that cannot be seen except by demolition of the building elements. In addition to pipe markers and/or stencils, arrow markers shall be used to indicate direction of flow.
B. As a minimum, locate pipe markers and/or stencils as follows:
   1. Provide a pipe marker at each valve to indicate proper identification of pipe contents. Where several valves exist on one (1) header, it is necessary to mark only the header.
   2. Every 20 feet in exposed and concealed areas on all piping systems. Provide at least one (1) pipe marker in each room on all piping systems.
   3. At each branch or riser take off on piping systems, excluding short takeoffs for fixtures and terminal units.
   4. Provide a pipe marker or stencil and an arrow marker at every point of pipe entry or exit where the pipe penetrates a wall, floor, service column or enclosure.
   5. At access doors, manholes and similar access points that permit view of concealed piping.
   6. Near major equipment items and other points of origination and termination.
C. Provide an arrow marker with each pipe marker pointing away from the pipe marker to indicate direction of flow.

D. Provide a double-ended arrow marker when flow can be in either or both directions.

E. Indicate delivered water temperature on domestic hot water supply and return lines.

F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

G. Identify control panels and major control components outside panels with plastic nameplates.

H. Identify valves in main and branch piping with tags.

I. Identify air terminal units and radiator valves with plastic nameplates.

J. Tag automatic controls, instruments and relays. Key to control schematic.

K. Provide ceiling tacks to locate valves, fan coil units, dampers or other concealed equipment above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

L. Identify pipe utilizing copper press fittings with markers stating, “Press-Fit” adjacent to each content identification marker.

M. Identify medium pressure gas piping (14 inches water column to 5psi) with the statement, “WARNING – ½ to 5psi NATURAL GAS”.

N. Identify right and left nipple and coupling union assemblies with the statement “Right/Left Nipple/Coupling”.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01, Division 20 & Division 23 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. Perform all Work required to provide and install piping insulation, jackets and accessories indicated by the Contract Documents with supplementary items necessary for proper installation.

1.3 REFERENCE STANDARDS
A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
C. All materials, installation and Workmanship shall comply with the applicable requirements and standards addressed within the following references:
   a. Austin Energy Green Building Program (AEGB) Basic Requirements 7 - Low Emitting Materials – Interior Paints and Coatings
   2. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
   9. ASTM C534 - Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
   11. ASTM C552 - Cellular Glass Thermal Insulation.
13. ASTM C585 - Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).


15. ASTM C610 - Molded Expanded Perlite Block and Pipe Thermal Insulation.


17. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.


20. ASTM C795 - Insulation For Use Over Austenitic Steel.


1.4 DEFINITIONS

A. Concealed: Areas that cannot be seen by the building occupants.

B. Interior Exposed: Areas that are exposed to view by the building occupants, including underneath countertops, inside cabinets and closets, and all equipment rooms.

C. Interior: Areas inside the building exterior envelope that are not exposed to the outdoors.

D. Exterior: Areas outside the building exterior envelope that are exposed to the outdoors, including building crawl spaces and loading dock areas.

1.5 QUALITY ASSURANCE

A. All piping requiring insulation shall be insulated as specified herein and as required for a complete system. In each case, the insulation shall be equivalent to that specified and materials applied and finished as described in these Specifications.

B. All insulation, jacket, adhesives, mastics, sealers, etc., utilized in the fabrication of these systems shall meet NFPA for fire resistant ratings (maximum of 25 flame spread and 50 smoke developed ratings) and shall be approved by the insulation manufacturer for guaranteed performances when incorporated into their insulation system, unless a specific product is specified for a specific application and is stated as an exception to this requirement.

1. Certificates to this effect shall be submitted along with Contractor’s submittal data for this Section of the Specifications.

2. No material shall be used that, when tested by the ASTM E84-89 test method, is found to melt, drip or delaminate to such a degree that the continuity of the flame front is destroyed, thereby resulting in an artificially low flame spread rating.

C. Application Company Qualifications: Company performing the Work of this Section must have minimum three (3) years experience specializing in the trade.
D. All insulation shall be applied by mechanics skilled in this particular Work and regularly engaged in such occupation.

E. All insulation shall be applied in strict accordance with these Specifications and with factory printed recommendations on items not herein mentioned. Unsightly, inadequate, or sloppy Work will not be acceptable.

1.6 SUBMITTALS

A. Product Data:
   1. Provide product description, list of materials, “k” value, “R” value, mean temperature range, and thickness for each service and location.
   2. Samples: When requested, submit three (3) samples of any representative size illustrating each insulation type

B. AEGB Submittal:
   1. Product data complying with Basic Requirements 7 - Low Emitting Materials – Interior Paints and Coatings
      a. Insulation containing no-added formaldehyde or ultra-low-emitting formaldehyde per CARB ATCM,
      b. VOC content for adhesives/sealants

C. Operation and Maintenance Data:
   1. Indicate procedures that ensure acceptable standards will be achieved. Submit certificates to this effect.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the Project Site in original factory packaging, labeled with manufacturer’s identification including product thermal ratings and thickness.

B. Store insulation in original wrapping and protect from weather and construction traffic. Protect insulation against dirt, water, chemical, and mechanical damage.

C. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics and insulation cements.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

B. Per AEGB IEQ7, all insulation must contain no added formaldehyde resins (including urea, phenol, and urea-extended phenol)

2.2 MANUFACTURERS

A. Insulation:
   1. Owens-Corning (Type P1).
   2. Certainteed Corporation (Type P1).
3. Johns Manville Corporation (Type P1).
4. Knauf Corporation (Type P1).
5. Dow Chemical Company (Type P2).
6. Armstrong/Armacell (Armaflex) (Type P3).
7. RBX Industries/Rubatex (Type P3).
8. Industrial Insulation Group, LLC (Type P4).
9. FOAMGLAS (Cellular Glass) by Pittsburgh Corning (Type P6).

B. Jackets:
2. PABCO.
3. RPR Products, Inc.
4. Alpha.
5. Venture Tape Corporation
6. Foamglas

2.3 INSULATION
A. Type P1: Fiberglass preformed insulation; ASTM C 547; minimum 3.0 lb/cu ft density, ASTM C335; 'k' value of 0.23 at 75 degrees F; noncombustible.

B. Type P2: Molded closed cell polyisocyanurate insulation; ASTM E96, maximum water vapor transmission rating of 0.005 Perm-In; ASTM C518, 'k' value of 0.20 at 75 degrees F; ASTM D2842, water absorption value of 0.05 lb/ft2.

C. Type P3: Elastomer, closed cell, flexible, insulation; ASTM E96; maximum vapor transmission rating of 0.20 perms; ASTM C 518; 'k' value of 0.27 at 75 degrees F.

D. Type P4: Mineral Wool; ASTM C 547; preformed insulation high temperature insulation; 'k' value of 0.35 at 300 degrees F.

E. Type P6: Cellular Glass, ASTM C552, 7.5 lbs./cu.ft, density, ASTM E96 (Wet Cup Method) 0.00 water vapor perm , ASTM C518 'k' value of 0.29 at 75 degrees F.

2.4 JACKETS
A. Jacket Materials:
2. Fiberglass Cloth Reinforcing Mesh: #10 glass cloth with minimum weight of 3.9 ounces per square yard.
3. Aluminum Jackets: ASTM B 209; 0.020 inch thick; smooth finish with factory applied moisture barrier.

B. Interior Concealed Applications:

1. Type P1 Insulation: Provide factory applied ASJ white kraft foil vapor barrier.

2. Type P3 Insulation: Finish coat is not required.

3. Type P4 Insulation: Cover with a canvas jacket, Adhesive Prime Coat # CP-52 and Childers #CP-50A HV2 lagging adhesive.

4. Type P6 Insulation: Provide Pittcoat 404 or pre-molded PVC covers per manufacturer’s recommendations. Jacketing material is not required when this type of piping insulation is concealed within a piping chase.

C. Interior - Exposed Applications:

D. Type P1, and P2 Insulation: Provide factory applied ASJ white kraft foil vapor barrier. Also finish with canvas jacket or #10 glass membrane with Childers CP-50 or approved equal finish. Apply sizing for finish painting. Verify jacket is suitable for applications.

1. Type P3 Insulation: Finish coat is not required.

2. Type P4 Insulation: Cover with a canvas jacket and Childers CP-50 lagging adhesive.

3. Type P6 Insulation: Provide triple ply laminate polypropylene, mold resistant with a metal foil and polyester vapor barrier film backing.

E. All exposed insulated piping within six feet of the floor shall be protected with an aluminum or stainless jacket material to protect the insulation jacketing material from being torn or punctured. Exterior Applications:

1. Insulate piping system as indicated under Interior - Exposed Applications, prior to final jacket installation.

2. Provide electric heat tracing for all exterior piping where water is susceptible to freezing.

3. Final jacket cover shall be aluminum jacket having integral moisture barrier with seams located at 2 or 10 o’clock position of horizontal piping. All laps must be minimum 2 inches.

2.5 INSERTS SUPPORTS AND SHIELDS

A. Application: Piping ½ inch diameter or larger for all systems except direct buried.

B. Shields shall be made of galvanized steel or made of black iron painted on both sides with a minimum two coats of aluminum paint. Required metal shield sizes are as follows:

<table>
<thead>
<tr>
<th>Nominal IPS (inches)</th>
<th>Metal Thickness (gage)</th>
<th>Minimum Lengths of Shield (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>½ to 1½</td>
<td>18</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>14</td>
<td>12</td>
</tr>
<tr>
<td>2-½ to 6</td>
<td>12</td>
<td>16</td>
</tr>
<tr>
<td>8 and above</td>
<td>10</td>
<td>20</td>
</tr>
</tbody>
</table>

C. Depending on the type of pipe support design, stainless steel bands or aluminum bands may be required to keep shield material next to the jacketing material.

Milam County Annex
Cameron, Texas 22 07 19 -5 Piping and Hydronic Insulation
D. Inserts for shields shall be manufactured of 7.5 lb/cu. ft. density cellular glass material suitable for the planned temperature range. Provide factory fabricated inserts with integral galvanized pipe saddles. Inserts shall be the same thickness as the adjacent insulation.

2.6 INSULATION ACCESSORIES

A. Insulation Bands: 3/4 inch wide; 0.007 inch thick galvanized steel when exposed to interior environment, .010 inch thick stainless steel or 0.015 inch thick aluminum when exposed to harsh humid interior environment or outside environment.

B. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum or 0.010 inch thick stainless steel to match jacket.

C. Insulating Cement: ASTM C 195; hydraulic setting mineral wool; Ryder One-Coat.

D. Sealants: Use at valves, fittings and where insulation is terminated. Brush apply sealant to end of insulation and continue along pipe surface. Provide Childers CP-70/CP-76 or equivalent sealant.

E. Adhesives: Use to adhere the longitudinal lap seam of vapor barrier jackets and at butt joints between insulation or fitting covers. Provide Childers CP-82 or approved equal as general purpose adhesive. Use Childers CP-97 fibrous adhesive for calcium silicate or when adhering pipe saddles and shields to the insulation.

F. Primers: Provide Childers CP-50 diluted 50 percent with water or Pittcoat 300 primer thinned with mineral spirits to cover insulating cements prior to finish coating.

G. Finish: Provide Childers CP-30 L.O. as a general purpose finish to coat the longitudinal seams and butt joints of vapor barrier jackets or glass cloth jackets. Use Childers CP-50 reinforced with glass cloth as an adhesive and sizing for canvas and in other locations as indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that piping has been pressure tested before applying paint and insulation materials.

B. Thoroughly clean all surfaces to be insulated as required to remove all oil, grease, loose scale, rust, and foreign matter. Piping must be completely dry at the time of application of primer paint. Painting on piping where condensation is occurring on the pipe surface is strictly prohibited.

C. Provide primer coat on all piping, to include field welds and over factory applied paint/coating, in total compliance with Contract Documents and compatible with and approved by the insulation manufacturer. Painting must be completed and approved prior to installation of insulation. Paint shall be applied in accordance with the paint manufactures instructions, environment, and pipe surface temperatures.

D. Painting is not required for piping insulated with P6 cellular glass insulation however piping needs to be dry when using PITTSEAL® CW Sealant, a high performance, MS Polymer based sealant for P6 cellular glass insulation for chilled water applications.

3.2 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. Installation of insulation and jacket materials shall be in accordance with manufacturer’s published instructions.

C. Handle and install materials in accordance with manufacturer’s instructions in the absence of specific instructions herein.

D. On exposed piping, locate insulation cover seams with the ridge of the lap joint is directed down.

E. Exposed Insulated piping within six feet of the floor shall be protected with an aluminum or stainless jacket material to protect the insulation.

F. Insulate fittings, joints and valves with molded insulation of the same material and thickness as adjoining pipe. Open voids and cracks insulation shall be kept at a minimum when placing insulation on abnormal or irregular shapes. Use closed cell or recommended fill material as instructed by the insulation manufacturer to close openings. Fiberglass insulation shall not be used as a fill material on chilled water piping or fittings.

G. Continue insulation through walls, sleeves, pipe hangers, floors, and other pipe penetrations.

H. Provide dams in insulation at intervals not to exceed 20 feet on cold piping systems to prevent migration of condensation or fluid leaks. Indicate visually where the dams are located for maintenance personnel to identify and also provide dams at butt joints of insulation at fittings, flanges, valves, and hangers.

I. Insulate entire system including fittings, valves, flanges and strainers. Use closed cell insulation on cold piping system flexible connections, expansion joints and unions, bevel and seal ends of insulation and continue sealant a minimum of 4 inches along the piping, unless stated otherwise.

J. For hot piping conveying fluids 180 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation. Continue sealant a minimum of 4 inches along the piping.

K. All sections of molded pipe covering shall be firmly butted together. Where an insulation covering is applied, it shall lap the adjoining section of insulation by at least three inches (3 inches). Where insulation terminates, it shall be neatly beveled and finished. All materials used shall be fire retardant or nonflammable.

L. Where vapor barriers are required, the vapor barrier shall be on the outside. Extreme care shall be taken that the vapor barrier is unbroken. Joints, etc., shall be sealed. Where insulation with a vapor barrier terminates, seal off with vapor barrier continuous to the surface being insulated. Ends shall not be left raw.

M. Where pipe chases are tight, adequate provision shall be made at the rough-in stage using offset fittings or other means (except springing the pipe) to ensure that insulation can be applied throughout the length of the pipe.

N. Paint exposed pipe insulation.

O. INSERTS, SUPPORTS, AND SHIELDS

1. Shields
   a. Install between pipe hangers or pipe hanger rolls and inserts. Curved metal shields shall be used between the hangers or support points and at the bottom of insulated pipe.
   b. Hangers shall support the load of the insulated pipe section on the outside of the insulation and shall not be in direct contact with the pipe.
c. Manufacturer shall be responsible to size the length of shield required to prevent insulation from breaking.

d. Provide rigid insulation at each support point, a minimum of 2 inches longer than shield length.

e. Curved metal shields shall be designed to limit the bearing stress on the insulation to 35 psi and shall be curved to fit up to mid-perimeter of the insulated pipe.

2. Seal all insulation at supports, protrusions and interruptions. Maintain vapor barrier with finish coat.

P. MAINTENANCE AND INSPECTION METHODS

1. Conduct periodic inspections as determined by the Owner, to address the following:

a. Replace missing insulation and protect adjacent insulation which can become burned or wet after maintenance has been performed to the system.

b. Repair leaks or spills and remove and replace damaged insulation.

c. Repair breaks, tears, cracks, or punctures of the vapor barrier or protective covering. Verify that the existing insulation is dry and if wet replace the entire affected section as described in this section.

d. On piping exposed to the outdoor environment, replace the affected section of insulation as described in this section and use galvanized steel, aluminum or stainless steel to protect the insulation from being crushed due to foot traffic or maintenance equipment. PVC is appropriate for interior areas not subject to foot traffic.

3.3 PIPING INSULATION APPLICATION AND THICKNESS SCHEDULE

A. In no case shall installed piping insulation have insulation thicknesses that are less than what is required by local energy codes and ASHRAE 90.1 (whichever is more stringent), based on comparable insulation conductivity values at the specified mean rating temperature.

<table>
<thead>
<tr>
<th>Piping Systems</th>
<th>Location</th>
<th>Type</th>
<th>Pipe Size</th>
<th>Insulation Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic Hot Water,</td>
<td>All</td>
<td>P6</td>
<td>All Sizes</td>
<td>1-1/2&quot;</td>
</tr>
<tr>
<td></td>
<td>Interior</td>
<td>P1</td>
<td>1-1/2&quot; &amp; Smaller</td>
<td>1/2&quot;</td>
</tr>
<tr>
<td></td>
<td>Concealed</td>
<td></td>
<td>2&quot; to 4&quot;</td>
<td>1/2&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5&quot; &amp; Larger</td>
<td>1/2&quot;</td>
</tr>
<tr>
<td>Domestic Cold Water</td>
<td>Interior</td>
<td>P6</td>
<td>1-1/2&quot; &amp; Smaller</td>
<td>3/4&quot;</td>
</tr>
<tr>
<td></td>
<td>Exposed</td>
<td></td>
<td>2&quot; to 4&quot;</td>
<td>3/4&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5&quot; &amp; Larger</td>
<td>1&quot;</td>
</tr>
<tr>
<td></td>
<td>Interior</td>
<td></td>
<td>1-1/2&quot; &amp; Smaller</td>
<td>1&quot;</td>
</tr>
<tr>
<td></td>
<td>Exposed</td>
<td></td>
<td>2&quot; to 4</td>
<td>1&quot;</td>
</tr>
<tr>
<td></td>
<td>Exterior</td>
<td>P6</td>
<td>All Sizes</td>
<td>1-1/2&quot;</td>
</tr>
</tbody>
</table>

Milam County Annex
Cameron, Texas 22 07 19-8 Piping and Hydronic Insulation
<table>
<thead>
<tr>
<th>Description</th>
<th>Interior Concealed</th>
<th>4” and Smaller</th>
<th>5” &amp; Larger</th>
<th>1”</th>
<th>1-1/2”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condensate Drain</td>
<td>P1</td>
<td>4” &amp; Smaller</td>
<td>5” &amp; Larger</td>
<td>1”</td>
<td>1-1/2”</td>
</tr>
<tr>
<td>Refrigerant Suction Piping (35 Degrees F – Nominal)</td>
<td>P3</td>
<td>2-1/2” &amp; Smaller</td>
<td>1”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underside of all Roof / Overflow Drain Bodies and related horizontal roof</td>
<td>P6</td>
<td>2” to 4”</td>
<td>3/4”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>drain lines to vertical leader</td>
<td></td>
<td>5” &amp; Larger</td>
<td>1”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Floor Drain Bodies and related horizontal Sanitary Drain Lines above floor</td>
<td>P6</td>
<td>2” to 4”</td>
<td>3/4”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>that receive cold condensate drainage.</td>
<td></td>
<td>5” &amp; Larger</td>
<td>1”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interior Exposed</td>
<td></td>
<td>2” to 4”</td>
<td>3/4”</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5” &amp; Larger</td>
<td>1”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chilled Water</td>
<td>P6</td>
<td>4” &amp; Smaller</td>
<td>2”</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6” &amp; Larger</td>
<td>2”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heating Hot Water (Maximum 250 Degrees F)</td>
<td>P6</td>
<td>2-1/2” &amp; Smaller</td>
<td>2”</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3” &amp; Larger</td>
<td>2”</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2-1/2” &amp; Smaller</td>
<td>2”</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3” &amp; Larger</td>
<td>2”</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>P1</td>
<td>2-1/2” &amp; Smaller</td>
<td>2”</td>
<td></td>
<td></td>
</tr>
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END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 & Division 20 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. Provide materials and installation for complete first class plumbing systems, within and to five feet beyond building perimeter unless noted otherwise on Contract Drawings; Sanitary Waste and Vent Piping, Storm Drain Piping, Domestic Water Piping, Domestic Water Valves, Testing and other normal parts that make the systems operable, code compliant and acceptable to the authorities having jurisdiction.

1.3 REFERENCE STANDARDS
A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:

1.4 QUALITY ASSURANCE
A. Manufacturer’s name and pressure rating shall be permanently marked on valve body.
B. The Contractor shall notify the manufacturer's representative prior to installing any copper press fittings. The Contractor shall obtain the representative’s guidance in any unfamiliar installation procedures. The manufacturer's representative of copper press fittings shall conduct periodic inspections of the installation and shall report in writing to the Contractor and Owner of any observed deviations from manufacturer’s recommended installation practices.
C. Manufacturer Qualifications: Company shall have minimum three years documented experience specializing in manufacturing the products specified in this section.
D. Installer Qualifications:
   1. Company shall have minimum three years documented experience specializing in performing the work of this section.
   2. Installation of plumbing systems shall be performed by individuals licensed by the Texas State Board of Plumbing Examiners as a Journeyman or Master Plumber. Installation may be performed by Apprentice Plumbers provided they are registered with the Texas State Board of Plumbing examiners and under direct supervision of a licensed plumber. All installation shall be supervised by a licensed Master Plumber.
   3. All installers of copper press fittings shall be trained by the fitting manufacturer's appointed representative. Written notification of training shall be submitted to Owner prior to any installation.

1.5 SUBMITTALS
A. Product Data:
1. Code and Standards compliance, manufacturer's data for pipe, fittings, valves and all other products included within this specification section.
2. Manufacturer’s installation instructions.

B. Record Documents:
   a. Record actual locations of valves, etc. and prepare valve charts.
   2. Test reports and inspection certification for all systems listed herein.
   3. Provide a certificate of completion detailing the domestic water system chlorination procedure and all laboratory test results.
   4. Submit proposed location of access panels which vary from quantities or locations indicated on Contract Drawings.
   5. Provide full written description of manufacturer’s warranty.

C. Operation and Maintenance Data:
   1. Include components of system, servicing requirements, Record Drawings, inspection data, installation instructions, exploded assembly views, replacement part numbers and availability, location and contact numbers of service depot.

1.6 DELIVERY, STORAGE AND HANDLING
   A. All materials shall be new, undamaged, and free of rust.
   B. Accept valves on Site in shipping containers and maintain in place until installation.
   C. Provide temporary protective coating and end plugs on valves not packaged within containers. Maintain in place until installation.
   D. Provide temporary end caps and closures on pipe and fittings. Maintain in place until installation.
   E. Protect installed piping, valves and associated materials during progression of the construction period to avoid clogging with dirt, and debris and to prevent damage, rust, etc. Remove dirt and debris and repair materials as work progresses and isolate parts of completed system from uncompleted parts.
   F. Protect all materials that are to be installed within this project from exposure to rain, freezing temperatures and direct sunlight. EXCEPTION: Materials manufactured for exterior locations.

1.7 EXTRA MATERIALS
   A. Provide the Owner with one differential pressure meter kit for use with domestic hot water return circuit balancing valves installed within this project. Kit shall include meter, hoses, connection accessories, circular slide rule, carrying case and valve manufacturer’s curve charts.

PART 2 - PRODUCTS

2.1 GENERAL
   A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
   B. Provide materials as specified herein and indicated on Contract Drawings. All materials and work shall meet or exceed all applicable Federal and State requirements and conform to adopted codes and ordinances of authorities having jurisdiction.
   C. Pressure ratings of pipe, fittings, couplings, valves, and all other appurtenances shall be suitable for the anticipated system pressures in which they are installed.

2.2 SANITARY WASTE AND VENT AND STORM DRAINAGE PIPING
   A. PVC Piping: Permitted for underground Sanitary, Strom or above grade Sanitary Vent unless restricted due to fire/smoke rating. Also permitted for above grade interior building Strom Piping with fire wrap insulation meeting the fire/smoke requirement in return air plenum.
      1. PVC Pipe: Schedule 40 ASTM D2665, solid-wall drain, waste, and vent. Foam-Core PVC is not permitted.

   1. Service weight cast iron soil pipe and fittings with hubless connections using clamp type gasked mechanical fasteners above ground and hub and spigot DWV pipe and fittings with neoprene compression gasket joints for all buried pipe. Cast iron soil pipe, fittings and hub gaskets shall be manufactured by Tyler Pipe or Charlotte Pipe and Foundry. All cast iron pipe and fittings shall be of the same manufacturer.
   2. Unburied storm drainage and sanitary waste and vent piping for sizes 4” and smaller may be seamless copper DWV tube with wrought copper or wrought copper alloy solder joint drainage pattern DWV fittings.
   3. Indirect waste piping sizes 1-1/4” through 2” serving fixtures and equipment shall be seamless copper DWV tube with wrought copper or wrought copper alloy solder joint drainage pattern DWV fittings.
   4. Indirect waste piping sizes 1” and smaller serving equipment shall be type "L" hard drawn copper pipe and wrought copper or cast copper alloy solder joint fittings using lead-free solder and non-corrosive flux. Elbows shall be long radius type. Tee fittings shall be combination wye with 45 degree elbow.
   5. Exposed sanitary drainage piping receiving condensate drain shall be copper. All above grade sanitary drainage line receiving condensate shall be insulated in its entirety.
   6. Cast iron soil pipe compression gaskets shall be monolithically molded from an elastomer meeting ASTM C 564 and shall be of same manufacturer as pipe and fittings.
   7. Lubricant for drainage cleanout plugs shall be Loctite Marine Grade Anti-Seize or approved equal by Bostik Chemical Group, or Dow Corning Corporation.
   8. Double sanitary tee fittings shall not be used as a drainage fitting.
   9. Provide IAPMO figure one, IAPMO figure five or double wye and eighth bend fittings on vertical lines serving back-to-back fixture drains.
   10. Double wye and eighth bend fittings shall not be installed in horizontal drain lines.
   11. All P-traps for floor drains, floor sinks and hub drains shall be deep-seal type.
   12. Provide threaded brass or copper adapters to connect fixture supply stops and waste to service piping within walls. Galvanized nipples shall not be acceptable. Provide DWV copper trap adapters to connect lavatory, sink and drinking fountain trap outlets to sanitary system.
   13. All storm drain bodies, the first 30' feet of pipe from the drain and all horizontal runs of storm drainage piping within the building, except in crawl space shall be insulated as described in the insulation specifications.

2.3 DOMESTIC WATER PIPING

A. All materials within domestic water distribution systems that may come in contact with the potable water delivered shall comply with ANSI/NSF Standard 61.
B. All brass and bronze piping materials within domestic water distribution systems that may come in contact with the potable water delivered shall have no more than 15% zinc content.
C. Exterior Underground piping below traffic areas and drives:
   1. Two-inch diameter and smaller: ASTM B 88 copper tubing, Type K, hard temper, with ASME B16.22 wrought copper fittings and brazed joints conforming to ASME A5.8 BCuP lead free brazing material and AWS A5.31 flux.
   2. Three-inch and larger: Ductile iron with boltless restrained joints rated for 250 PSI operating pressure, using mechanical joints. All buried ductile iron pipe and fittings shall be encased in polyethylene per ANSI/AWWA Standard C105/A21.5, Method A. Minimum thickness of polyethylene shall be 8 mil.
   3. Design underground piping systems to accommodate expansion and contraction of piping using expansion and offset loops, without the use of slop couplings.
D. Below Grade in areas not exposed to traffic:
1. Two-inch diameter and smaller: ASTM B 88 copper tubing, Type L, hard temper, with ASME B16.22 wrought copper fittings and brazed joints conforming to ASME A5.8 BCuP lead free brazing material and AWS A5.31 flux.


3. Design underground piping systems to accommodate expansion and contraction of piping using expansion and offset loops, without the use of slope couplings.

E. Above Grade:

1. 2-1/2 inch diameter and smaller: ASTM B 88, Type L, hard drawn copper with ASME B16.18 cast bronze or ASME B16.22 wrought copper and bronze fittings and soldered joints using ASME B 32, Grade 95T solder and ASTM B 813 flux.

2. 3-inch to 4-inch diameter: ASTM B 88, Type L, hard drawn copper with ASME B16.18 cast bronze or ASME B16.22 wrought copper and bronze fittings and brazed joints using ASME A5.8 BCuP lead free brazing material and AWS A5.31 flux. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

3. Piping larger than 4-inch diameter: ASTM A 53 galvanized steel pipe, schedule 40, cast iron fittings, galvanized, grooved mechanical coupling joints. Copper Pressure-Seal-Joint Fittings.

F. Copper press fittings shall be rated at 200 psi working pressure and 250 degree working temperature. All copper press fittings, couplings and specialties shall be the products of a single manufacturer. Installation tools shall be as recommended by the fittings manufacturer.

G. Solder for copper piping shall be lead-free Tin/Copper/Silver/Nickel(optional) solder conforming to ASTM B32, Wolverine Silvabrite 100 Lead-Free Solder or Harris Nick Lead-Free Solder. Use water soluble flux recommended by solder manufacturer and conforming to ASTM B813 and NSF 61, Wolverine Silvabrite 100 Water Soluable Flux or Bridgit Water Soluble Paste Flux.

H. No joints shall be allowed below slab. Encase piping within ½” thick un-slit flexible tube type elastomeric thermal insulation up to 1” above slab at both ends. Insulation shall be AP/Armaflex or Rubatex Insul-Tube 180.

I. Unburied trap primer piping shall be same as specified for domestic water except all elbows shall be long radius type.

J. Buried trap primer piping shall be type “L”. No joints shall be allowed below slab except at connection to drain. Encase piping within ½” thick un-slit flexible tube type elastomeric thermal insulation up 1” above slab. Insulation shall be AP/Armaflex or Rubatex Insul-Tube 180.

K. Dielectric waterway fittings shall have zinc electroplated steel pipe body with high temperature stabilized polyolefin polymer liner; manufactured by Victaulic, Style 47 or PPP, Inc. Series 19000.

L. Dielectric unions shall be rated at 250 psi, ground-joint type with inert, non-corrosive thermoplastic sleeve. End connection materials shall be compatible with respective piping materials; manufactured by EPCO Sales, Inc. Provide models to suit applicable transitions.

M. Dielectric flanges shall be rated at 175 psi, have nylon bolt isolators and dielectric gasket. Materials shall be compatible with respective piping materials; manufactured by EPCO Sales, Inc. Provide models to suit applicable transitions.

N. Pipe joint compound shall be lead-free, non-toxic, non-hardening and compliant with ANSI/NSF 61 and Federal Specification TT-S-1732. Temperature service range of -15°F to +400°F, manufactured by Hercules “MegaLoc” or approved equal by Rectorseal, La-Co or Oatey.

O. All exterior water piping installed above grade shall be provided with electric heat in the form of 120 volt, single phased tape rated at 5 watts per lineal foot at 50°F. Heat tracing shall be manufactured for freeze protection service and be self-regulating to energize at 50°F. Provide an accessible temperature sensing thermostat between electrical power supply and connections to heat tracing to prevent power from activating tracing unless outside ambient temperature is at or below 40°F. This Contractor shall coordinate with the electrical Contractor to provide electrical power supply and connection. Heat tracing shall be by Raychem XL-TRACE or Thermon FLX. Thermostats shall be Raychem AMC-F5 or Thermon N4X-40.
2.4 DOMESTIC WATER VALVES:

A. All materials within domestic water distribution systems that may come in contact with the potable water delivered shall comply with ANSI/NSF Standard 61.

B. All brass and bronze valve materials within domestic water distribution systems that may come in contact with the potable water delivered shall have no more than 15% zinc content.

C. Similar types of valves shall be the product of one manufacturer; i.e., all butterfly valves shall be of the same manufacturer, all ball valves shall be of the same manufacturer, etc. EXCEPTION: 2-1/2” & 3” ball valves may be by a different manufacturer than 2” and smaller ball valves.

D. Line Shut-Off Valves up to and including 2” shall be two-piece bronze body of ASTM B584 Alloy 844, ASTM B61, or ASTM B62, full port ball type rated at 600 WOG with threaded connections, blow-out proof stem, plastic coated lockable lever handle, Teflon packing, 316 stainless steel ball and stem. Acceptable valves are NIBCO Model T-585-70-66-LL, or approved equivalent model by Crane, Milwaukee or Apollo.

E. Line Shut-Off Valves sizes 2-1/2” and 3” shall be full port ball type rated at 400 WOG with threaded connections, two-piece bronze body ASTM B584 with 316 stainless steel ball and stem, plastic coated lockable lever handle, blow out proof stem and reinforced Teflon seats. Acceptable valves are Kitz Model 68PM, or approved equivalent model by Crane, NIBCO, Milwaukee or Apollo.

F. Provide stem extensions of a non-thermal conducting material for valves in insulated lines to allow unobstructed operation.

G. Provide memory stops on all ball valves installed in domestic hot water return lines. Memory stops shall be adjustable after pipe insulation is applied.

H. Provide line shut-off valves that have the same inside diameter of the upstream pipe in which they are installed.

I. Swing Check Valves, 2” and smaller - “Y” or “T” pattern bronze, Class 150, with threaded connections and screw-in cap. Manufactured by NIBCO Model T-433-Y or approved equivalent model by Milwaukee or Crane.

J. Spring Loaded Check Valves, 2” and smaller - Silent closing, bronze, Class 125, with threaded connections, Buna disc, bronze or stainless steel spring. Manufactured by NIBCO Model T-480 or approved equivalent model by Milwaukee or Crane.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that excavations are to required grade, dry and not over-excavated. Do not install underground piping when bedding is wet or frozen.

B. Before commencing work, check final grade and pipe invert elevations required for drain terminations and connections to ensure proper slope.

3.2 PREPARATION

A. Ream pipes and tubes. Remove burrs, scale and dirt, inside and outside, before assembly. Remove foreign material from piping.

B. Prepare piping connections to equipment with flanges or unions.

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 manufacturer’s published recommendations.

C. General

1. Care shall be exercised to avoid all cross connections and to construct the plumbing systems in a manner which eliminates the possibility of water contamination.
2. Install all materials and products in accordance with manufacturer’s published recommendations. Use tools manufactured for the installation of the specific material or product.

3. Heat generated by soldering procedures shall not be transmitted to valves, copper alloy roll groove fittings, copper press fittings, no-hub clamps, or any other components installed within the piping system that may be damaged due to high temperatures. Contractor shall take all precautions necessary, including utilizing wet wrapping or allowing heated piping to cool to ambient temperature before attachment.

4. Pipe joints, no-hub clamps, flanges, unions, etc., shall not directly contact or be encased in concrete, or be located within wall, floor or roof penetrations.

5. Route piping in direct orderly manner and maintain proper grades. Installation shall conserve headroom and interfere as little as possible with use of spaces. Route exposed piping parallel to walls. Group piping whenever practical at common elevations.

6. Install piping to allow for expansion and Contraction without stressing pipe, joints or connected equipment.

7. Furnish all supports required by the piping included in this specification section.

8. Penetrations through fire rated walls, floors and partitions shall be sealed to provide a U.L. rating equal to or greater than the wall, floor or partition.

9. Seal all penetrations through floors, exterior building walls and grade beams air and water tight.

10. Each plumbing pipe projecting through roof shall be installed in accordance with Contract Specifications and Drawings. Penetrations shall be sealed air and water tight. Refer to details on Contract Drawings and coordinate with General Contractor for flashing requirements.

11. Furnish and install all necessary valves, traps, gauges, strainers, unions, etc. for each piece of equipment (including Owner furnished equipment) having plumbing connections, to facilitate proper functioning, servicing and compliance with code.

12. Provide code-approved transition adapters when joining dissimilar piping materials. Adaptors installed shall be manufactured specifically for the particular transition.

13. All piping shall have reducing fittings used for reducing or increasing where any change in the pipe sizes occurs. No bushing of any nature shall be allowed in piping.

14. Bury outside water and drainage pipe minimum one foot below recorded frost depth.

15. Buried piping shall be supported throughout its entire length.

16. All excavation required for plumbing work is the responsibility of the plumbing Contractor and shall be done in accordance with Contract Documents.

17. Piping shall be insulated in accordance with Contract Documents.

18. Provide clearance for installation of insulation and for access to valves, air vents, drains, unions, etc.

19. Provide dielectric isolation device where non-ferrous components connect to ferrous components. Devices shall be dielectric union, coupling or dielectric flange fitting.

20. All piping shall be isolated from building structures, including partition studs, to prevent transmission of vibration and noise.


D. Drainage and Vent Systems

1. Slope drainage lines uniformly at 1/4" per foot, for lines 3” and less, and 1/8" per foot for larger lines, unless noted otherwise on Contract Drawings. Maintain gradients through each joint of pipe and throughout system.

2. Buried pipe shall be laid on a smoothly graded, prepared subgrade soil foundation true to alignment and uniformly graded. Bell holes shall be hand-excavated so that the bottom of the pipe is in continuous contact with the surface of the prepared subgrade material. Piping invert shall form a true and straight line.

3. The size of drainage piping shall not be reduced in size in the direction of flow. Drainage and vent piping shall conform to the sizes indicated on the Contract Drawings. Waste lines from water closets shall not be smaller than four inches. Under no circumstances shall any drain or vent line below slab be smaller than two inches.
4. Unburied horizontal cast iron soil piping shall be supported at least at every other joint except that when the developed length between supports exceeds four feet, they shall be provided at each joint. Supports shall also be provided at each horizontal branch connection and at the base of each vertical rise. Supports shall be placed immediately adjacent to the joint. Suspended lines shall be braced to prevent horizontal movement. Unburied vertical cast iron soil piping rising through more than one floor level shall be supported with riser clamps at each floor level.

5. Install couplings for hubless pipe and fittings in accordance with manufacturer's published recommendations. Use pre-set torque wrench and tighten band screws to 80 inch pounds minimum or as required by manufacturer's published instructions.

6. All unburied change of direction fittings within the roof drainage system shall be braced against thrust loads that might result in joint separation due to dynamic forces caused by sudden, heavy rainfall conditions. Bracing shall incorporate galvanized steel pipe clamps and tie rods.

7. Provide cleanouts within sanitary waste systems at locations and with clearances as required by the code, at the base of each waste stack and at intervals not exceeding 75 feet in horizontal runs.

8. Provide cleanouts at the base of each vertical downspout and at intervals not exceeding 75 feet in horizontal building storm drain. Provide clearances as required by code. Horizontal roof drain piping located above building ground floor level will not require cleanouts.

9. A removable sink or lavatory p-trap with cleanout plug shall be considered as an approved cleanout for 2" diameter pipe.

10. All interior cleanouts shall be accessible from walls or floors. Provide wall cleanouts in lieu of floor cleanouts wherever possible. A floor cleanout shall be installed only where installation of a wall cleanout is not practical.

11. Provide a wall cleanout for each water closet or battery of water closets. Locate wall cleanouts above the flood level rim of the highest water closet but no more than twenty four inches above the finished floor.

12. Coordinate the location of all cleanouts with the architectural features of the building and obtain approval of locations from the Project Architect.

13. Lubricate cleanout plugs with anti-seize lubricant before installation. Prior to final completion, remove cleanout plugs, re-lubricate and reinstall using only enough force to provide a water and gas tight seal.

14. Install trap primer supply to floor drains, hub drains and floor sinks that are susceptible to trap seal evaporation and where indicated on Project Drawings. Primer unit installation shall comply with manufacturer's published recommendations. Trap primer lines shall slope to drain at a minimum ¼" per foot.

15. Capped waste and vent connections for future extensions shall be located accessibly and not extend more than 24” from active main. Waste connections and vent connections shall be located at elevations that will allow future installation of properly sloped piping without the need to dismantle or relocate installed ductwork, piping, conduit, light fixtures, etc.

16. Unless indicated otherwise within Contract Documents, all sanitary vent pipes passing through the roof shall be provided with roof flashings with bases extending no less than ten inches on each side of the pipe. The vertical portion of the flashing shall extend upward the entire length of pipe and be turned tightly inside the pipe at least two inches and shall not reduce the inside diameter of vent pipe more than the thickness of the flashing. Flashings shall be furnished by Plumbing Contractor and turned over to Roofing Contractor for installation.

17. Locate all sanitary vent terminals a minimum of 25 feet horizontally from or 3 feet vertically above all air intakes, operable windows, doors and any other building openings.

18. Wastewater when discharged into the building drainage system shall be at a temperature not higher than 140°F. When higher temperatures exist, approved cooling methods shall be provided.

E. Domestic Water System
1. On each water supply line serving a plumbing fixture, item of equipment, or other device which has a water supply discharge outlet below the overflow rim, or where cross contamination may occur, provide and install an approved vacuum breaker or backflow preventer. Installation of vacuum breakers shall prevent any possible backflow through them.

2. Provide thrust blocking and clamps for mechanical joint or gasketed underground water pipe at fittings with 3/4" rods, and properly anchor and support. Restraining rods, clamps and hardware shall be thoroughly coated with bituminous material to prevent corrosion.

3. Copper piping shall be supported at no greater than six foot intervals for piping 1-1/2" and smaller and ten foot intervals for piping 2" and larger in diameter.

4. Install all water piping to allow all piping within the system to be drained at low points.

5. Air chambers, dead-legs, or any other piping arrangement that may allow water to stagnate shall not be installed within domestic water systems. Valves installed for future connections shall not extend more than 24" from an active main.

6. Provide manufactured water hammer arrestors in water supply lines as indicated on Contract Drawings and in accordance with Standard PDI-WH201.

7. Pipe insulation shall be applied over installed freeze protection heat tracing tape.

8. Install union type fitting downstream of isolation valves at equipment connections.

9. Solder joint fittings shall not be installed within 24" of a copper press fitting.

10. Threaded adaptors shall be of the same manufacture and type as the system's copper fittings.

11. Threaded adaptors on supply stub-outs shall be installed prior to construction of wall and shall not extend more than 1" beyond wall face.

12. Identify piping utilizing copper press fittings in accordance with project specification section 20 05 53.

F. Domestic Water Valves

1. Domestic water shut-off valves shall be installed where shown on Drawings, at each fixture and piece of equipment, at each branch take-off from mains, at the base of each riser, and at each battery of fixtures.

2. Install shut-off valves in accessible locations. Provide access panels where valves would otherwise be inaccessible. Coordinate quantity, size and location requirements of access panels with General Contractor.

3. Install shut-off valves with stems upright or horizontal, not inverted.

4. Where threaded valves are installed in copper piping systems special care shall be taken to avoid damaging the valve or its parts due to overheating. Install copper or bronze male adapters in each inlet of threaded valves. Sweat solder adapters to pipe prior to connecting to valve body.

5. Provide spring loaded type check valves on discharge of water pumps.

6. Provide accessible check valves in the individual cold and hot water fixture supply lines serving mixing valve type faucets or assemblies having hose connection outlets that are not equipped with integral check stops.

7. Install domestic hot water return circuit balancing valves where indicated on Contract Drawings and locate a minimum of five pipe diameters downstream and three pipe diameters upstream of all fittings and/or line shut-off valves. Location of valves shall allow unobstructed access for monitoring and adjustment.

8. Adjust and set domestic hot water return circuit balancing valves to flows indicated on Contract Drawings and in accordance with valve manufacturer’s published instructions. Use flow meter recommended by valve manufacturer.

9. Provide a temperature gauge, strainer, union and line shut-off valve upstream of each hot water return circuit balancing valve.

3.4 TESTING

A. General
1. Equipment, material, power, and labor necessary for the cleaning, flushing, sterilization, inspection and testing of systems covered within this Specification Section shall be furnished by the Plumbing Contractor. All testing and inspection procedures shall be in accordance with Division 1 and Special Condition requirements of this Contract.

2. All new and parts of existing altered, extended, or repaired plumbing system piping shall be tested and inspected for leaks and defects. Piping being tested shall not leak nor show any loss in test pressure for duration specified.

3. In cases of minor installation and repairs where specified water and/or air test procedures are deemed impractical, Contractor shall obtain written approval from Owner’s Representative to perform alternate testing and inspection procedures. Alternate testing and inspection procedures for minor installation and repairs shall include visual evaluation of installed components by Owner’s Representative during a simulation of use.

4. The water utilized for tests shall be obtained from a potable source of supply.

5. Prepare testing reports. If testing is performed in segments, submit separate report for each segment, complete with diagram or clear description of applicable portion of piping. After inspection has been approved or portions thereof, certify in writing the time, date, name and title of the persons reviewing the test. This shall also include the description of what portion of the system has been approved. Obtain approval signature by Owner’s Representative. A complete record shall be maintained of all testing that has been approved, and shall be made available at the job Site. Upon completion of the work, all records and certifications approving testing requirements shall be submitted to the Owner’s Representative before final payment is made.

6. Verify systems are complete, flushed and clean prior to testing. Isolate all equipment subject to damage from test pressure. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. Leave piping uninsulated, uncovered and unconcealed until it has been tested and approved. Where any portion of piping system must be concealed before completion of entire system, the portion shall be tested separately as specified for the entire system prior to concealment. Contractor shall expose all untested covered or concealed piping.

7. Gauges used for testing shall have increments as follows:
   a. Tests requiring a pressure of 10 psi or less shall utilize a testing gauge having increments of 0.10 psi or less.
   b. Tests requiring a pressure of greater than 10 psi but less than or equal to 100 psi shall utilize a testing gauge having increments of 1 psi or less.
   c. Tests requiring a pressure of greater than 100 psi shall utilize a testing gauge having increments of 2 psi or less.

8. Separately test above and below ground piping.

9. Do not introduce test water into piping systems when exposure to freezing temperatures is possible.

10. Do not introduce test water into sections of piping located above existing sensitive areas and/or equipment that may be damaged or contaminated by water leakage. Coordinate with Owner’s Representative to determine areas and/or equipment considered as being sensitive.

11. Defective work or material shall be reworked and replaced, and inspection and test repeated. Repairs shall be made with new materials. Pipe dope, caulking, tape, dresser couplings, etc., shall not be used to correct deficiencies.

12. The Contractor shall be responsible for cleaning up any leakage during flushing, testing, repairing and disinfecting to the original condition any building parts subjected to spills or leakage.

B. Drainage and Vent System
1. Subject gravity drainage and vent piping and joints to a vertical water column pressure of at least ten feet. If after 12 hours the level of the water has been lowered by leakage, the leaks must be found and stopped and the water level shall again be raised to the level described and the test repeated until, after a 12 hour retention period, there shall be no perceptible lowering of the water level in the system being tested. EXCEPTION: Portions of drainage and vent piping located on uppermost level of building shall be subjected to a water column pressure created by filling the system to point of overflow at roof vent terminals and roof drains. The pipes for the level being tested shall be filled with water to a verifiable and visible level as described above and be allowed to remain so for 12 hours.

2. Piping located above sensitive areas and/or equipment that may be damaged or become contaminated due to test water leakage shall be tested with air. Isolate the test section from all other sections and slowly fill pipe with oil-free air until there is a uniform gauge pressure of 5 pounds per square inch (34.5 kPa) or sufficient pressure to balance a 10-inch (254 mm) column of mercury. The air pressure shall be regulated to prevent the pressure inside the pipe from exceeding 5.0 PSIG. This pressure shall be held for a test period of at least 15 minutes. Any adjustments to the test pressure required because of changes in ambient temperature or the seating of gaskets shall be made prior to the beginning of the test period.

3. Test forced (pumped) drainage piping by plugging the end of the piping at the point of connection with the gravity drainage system and applying a pressure of 5 psi (34.5 kPa) greater than the pump rating, and maintaining such pressure for 15 minutes.

4. Should the completion of these tests leave any reasonable question of a doubt relative to the integrity of the installation, additional tests or measures shall be performed to demonstrate the reliability of these systems to the complete satisfaction of the Owner’s Representative.

5. Test plugs must extend outside the end of pipe to provide a visible indication for removal after the test has been completed.

C. Domestic Water System

1. Subject piping system to a hydrostatic pressure of at least 125 pounds per square inch gauge, but not less than the operating pressure under which it is to be used, for a period of no less than 12 hours. During test period, all pipe, fittings and accessories in the particular piping system that is being tested shall be carefully inspected. If leaks are detected, such leaks shall be stopped and the hydrostatic test shall again be applied. This procedure shall be repeated until no leaks are detected for an entire 12 hour period. EXCEPTION: Piping located above sensitive areas and/or equipment that may be damaged or become contaminated due to test water leakage shall be tested with oil-free air in lieu of water.

2. After completion of the testing, all new and/or altered water piping systems shall be thoroughly sterilized with a solution containing not less than 50 parts per million of available chlorine. Do not exceed 150 parts per million at any time. Introduce chlorine into the supply stream at a rate sufficient to provide a uniform concentration throughout the system. All outlets shall be opened and closed several times. When the specified level of chlorine is detected at every outlet in the system, close all valves to prevent release of water from the system for 24 hours. At the completion of the 24 hour disinfection period, test every outlet for a minimum chlorine residual of fifty parts per million. This minimum residual must be present to proceed with flushing. Flush the system with clean water at a sufficient velocity until the residual chlorine detected at every outlet is within 0.2 parts per million of the normal water supply’s level.
3. Sufficient samples must be taken no sooner than 24 hours after sterilization and flushing to represent the extent and complexity of the affected water system, along with a control sample to indicate municipal water quality at the time of testing. Send water samples to an accredited laboratory to perform qualitative and quantitative bacteriological analysis in accordance with AWWA C651. Contractor shall obtain written certification from the independent testing agency stating that the water samples meet Federal and State guidelines for safe drinking water. Upon satisfactory completion of all procedures, and receipt of acceptable laboratory test results, obtain written approval by Owner's representative. Failure to fully comply with the above procedures will result in a requirement to repeat the procedure until acceptable results are achieved, at no additional cost to the Owner.

4. Isolate or bypass equipment that would be detrimentally affected by disinfecting solution. Isolate all other sections of the domestic water system not being disinfected to prevent migration of chlorine.

5. Prior to injection of chlorine into the piping system, strategically place signs stating “Heavily Chlorinated Water - Do Not Drink”, and protect all outlets to prevent use during disinfection and flushing procedures.

D. A bacteria test is not necessary for small scale work. However, disinfection is required. Examples of small scale work are less than 20 feet of pipe, replacement and/or installation of a sink, drinking fountain, eyewash, backflow preventer, isolation valve, etc. Disinfect individual parts, fixtures, isolation valves, pipes, etc. by swabbing with full strength bleach (5.25%) or soaking for at least 30 minutes in a 500 ppm chlorine solution. The 500 ppm solution can be made by adding one part 5.25% bleach (household bleach) to 100 parts drinking water. For example 3-1/2 ounces of bleach can be added to 2-1/2 gallons drinking water. Materials should then be thoroughly rinsed before putting into service.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary
      Conditions and Division 01 & Division 20 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. Provide all materials and installation for plumbing specialties within building domestic water,
      sanitary waste and storm drainage systems; floor drains, floor sinks, hub drains, roof drains,
      cleanouts, backflow preventers, vacuum breakers, pressure regulating valves, water
      hammer arrestors, wall hydrants, hose bibbs, trap primer units, strainers, temperature
      gauges, pressure gauges and other normal parts that make the systems complete, operable,
      code compliant and acceptable to the authorities having jurisdiction.

1.3 REFERENCE STANDARDS
   A. The latest published edition of a reference shall be applicable to this Project unless identified
      by a specific edition date.
   B. All reference amendments adopted prior to the effective date of this Contract shall be
      applicable to this Project.
   C. All materials, installation and workmanship shall comply with the applicable requirements
      and standards addressed within the following references:

1.4 QUALITY ASSURANCE
   1. Manufacturer’s name and pressure rating shall be permanently marked on valve body.
   2. All materials shall be new, undamaged, and free of rust. Protect installed products and
      associated materials during progression of the construction period to avoid clogging
      with dirt, and debris and to prevent damage, rust, etc. Remove dirt and debris as work
      progresses.
   3. Manufacturer Qualifications: Company shall have minimum three years documented
      experience specializing in manufacturing the products specified in this section.
   4. Installer Qualifications: Company shall have minimum three years documented
      experience specializing in performing the work of this section. Installation of plumbing
      systems shall be performed by individuals licensed by the Texas State Board of
      Plumbing Examiners as a Journeyman or Master Plumber. Installation may be
      performed by Apprentice Plumbers provided they are registered with the Texas State
      Board of Plumbing examiners and under direct supervision of a licensed plumber. All
      installation shall be supervised by a licensed Master Plumber.

1.5 SUBMITTALS
   A. Product Data:
      1. Provide Code and Standards compliance, component dimensions, service sizes and
         finishes.
   B. Record Documents:
      1. Manufacturer’s certification documentation for backflow preventers.
2. Submit proposed location of access panels which vary from quantities or locations indicated on Contract Drawings.
3. Provide full written description of manufacturer’s warranty.
4. Record actual locations of plumbing specialties installed.

C. Operation and Maintenance Data:
1. Include testing procedures for backflow preventers, adjustment procedures for water pressure regulating valves.
2. Include installation instructions, exploded assembly views, servicing requirements, inspection data, installation instructions, spare parts lists, replacement part numbers and availability, location and contact numbers of service depot, for all plumbing specialties installed.

1.6 DELIVERY, STORAGE AND HANDLING
A. Accept specialties on site in shipping containers and maintain in place until installation.
B. Provide temporary protective coating and end plugs on valves not packaged within containers. Maintain in place until installation.
C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work and isolating parts of completed system.
D. Protect all materials before and after installation from exposure to rain, freezing temperatures and direct sunlight. EXCEPTION: Materials manufactured for installation within exterior environments.

1.7 EXTRA MATERIALS
A. Provide two loose keys for each type of wall hydrant box.
B. Provide manufacturer’s standard test kit for each type of backflow preventer installed.

PART 2 - PRODUCTS

2.1 GENERAL
A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
B. Provide plumbing specialties as indicated and scheduled on the Contract Drawings and as specified herein. All materials and work shall meet or exceed all applicable Federal and State requirements and conform to adopted codes and ordinances of authorities having jurisdiction.
C. Pressure and temperature ratings of plumbing specialties shall be suitable for the anticipated system pressures and temperatures in which they are installed.
D. All materials within domestic water distribution systems that may come in contact with the potable water delivered shall comply with ANSI/NSF Standard 61.
E. All brass and bronze plumbing specialties within domestic water distribution systems that may come in contact with the potable water delivered shall have no more than 15% zinc content.
F. Specialties of same type shall be product of one manufacturer.

2.2 ACCEPTABLE MANUFACTURERS
A. Floor Drains: Wade, Zurn, Smith, Josam.
B. Floor Sinks: Wade, Zurn, Smith, Josam.
C. Wall/Floor Cleanouts: Wade, Zurn, Smith, Josam.
E. Water Pressure Regulating Valves: Wilkins, Watts Regulator, Cla-Val.
F. Water Hammer Arrestors: Wade, Zurn, Smith, Josam.
G. Wall Hydrants: Wade, Zurn, Smith, Josam.
H. Hose Bibbs: Chicago.
I. Trap Primer Units: As Specified Herein
J. Stainers: Conbraco, Wilkins, Watts
2.3 FLOOR DRAINS (FD)

A. All floor drains shall be furnished and installed with all options and accessories required for a waterproof installation within the particular construction in which they are to be mounted.
B. Each floor drain shall be provided with a trap primer unless noted otherwise.
C. Floor drains installed for general floor area drainage within toilet rooms and other finished spaces shall have cast iron body with flange, adjustable top and sediment bucket, integral reversible clamping collar, seepage openings, 1/2” plugged primer tap, and 6” diameter nickel bronze or stainless steel strainer with vandal proof screws.
D. Floor drains installed for general floor area drainage and light to medium flow indirect equipment discharge within mechanical rooms shall have cast iron body with plugged 1/2” primer tap, integral clamping collar, seepage openings, adjustable top and 11-1/2” diameter ductile iron loose set tractor grate.
E. Floor drains installed for non-monolithic shower stall floors shall have cast iron body with flange, adjustable top and sediment bucket, integral reversible clamping collar, seepage openings and 5” diameter nickel bronze or stainless steel strainer with vandal proof screws.
F. All floor drains shall be as sized and scheduled on Contract Drawings.

2.4 FLOOR SINKS (FS)

A. All floor sinks shall be furnished and installed with all options and accessories required for a waterproof installation within the particular construction in which they are to be mounted.
B. Each floor sink shall be provided with a deep-seal p-trap unless noted otherwise.
C. Floor sinks installed for general floor area drainage shall have 8” round cast iron body with 3” sump, acid resistant enamel interior, aluminum dome strainer, seepage flange, membrane clamping device and 7-3/8” diameter stainless steel or nickel bronze top.
D. Floor sinks installed to receive indirect equipment discharge shall have cast iron 12” square body with 8” sump, acid resistant enamel interior, aluminum dome strainer, seepage flange, membrane clamping device and stainless steel top. Top shall be ½ or ¾ grate as scheduled on Drawings.
E. All floor sinks shall be as sized and scheduled on Contract Drawings.

2.5 HUB DRAINS (HD)

A. Hub drains shall be cast iron soil pipe hubs or hub adapters set with top of hub one-half inch (1/2”) above finished floor. Each hub drain shall be provided with a trap primer.

2.6 CLEANOUTS:

A. Cleanouts shall be the same nominal size as the pipe they serve up to four inches. For pipes larger than four inches nominal size, the size of cleanouts shall be six inches.
B. Cleanouts shall have cast iron body with tapered cast brass or bronze plug providing gas and watertight seal.
C. Interior floor cleanouts shall have stainless steel or nickel bronze scoriated top. Provide carpet marker when installed in areas to be covered by carpet.
D. Exterior cleanouts at grade shall have scoriated cast iron top.
E. Wall cleanouts shall be provided with stainless steel access covers of adequate size to allow rodding of drainage system. Wall cleanouts incorporating cover screws that extend completely through the access plug are not acceptable.

2.7 BACKFLOW PREVENTERS (INCLUDES BACKPRESSURE AND BACKSIPHONAGE)

A. Reduced Pressure Zone Type (Not For Use In Fire Protection Water Supply):
   1. The assembly shall meet the requirements of ASSE 1013, AWWA C511.
2. The assembly shall consist of a pressure differential relief valve located in a zone between two positive seating check valves and captured springs. Backsiphonage protection shall include provision to admit air directly into the reduced pressure zone via a separate channel from the water discharge channel. The assembly shall include two tightly closing shutoff valves before and after the valve and test cocks.

3. Test cocks

4. Seats: Bronze, removable and replaceable without removing valve from the line.

5. Checks: Independently operating.

6. Relief Valve: Independently operating, located between the two check valves.

7. Rated 175 psi maximum working pressure with continuous temperature range of 33 to 140°F.

8. Unit to be complete with vent-port funnel to maintain the air gap and to provide a drain connection point.

9. Sizes 1/4" and 1/2" - Bronze body, bronze strainer, upstream and downstream quarter-turn ball valves, union connections: Watts Regulator Company Series 009.

10. Sizes 3/4" through 2" - Bronze body, bronze strainer, upstream and downstream quarter-turn ball valves, union connections: Watts Regulator Company Series 919.

11. Sizes 2-1/2" through 10" - FDA epoxy coated cast iron body, FDA epoxy coated strainer, upstream and downstream OSY – UL/FM outside stem and yoke resilient seated gate valves, flange connections: Watts Regulator Company Series 909.

2.8 WATER PRESSURE REGULATING VALVES

A. Low to Moderate Flow Systems (Less Than 70 GPM) and Individual Equipment

1. Sizes 1/2" through 2"
2. All bronze body
3. 0.25% maximum weighted average lead content
4. Integral stainless steel strainer screen
5. Built-in bypass check valve
6. FDA approved elastomers
7. Renewable seat
8. Union end connection
9. Rated for water temperature up to 180°F and minimum 300 psi inlet pressure. Provide model with inlet pressure rating, reduced pressure range and factory preset outlet pressure as scheduled on Contract Drawings.
10. Manufactured by Wilkins Series 600XL or approved equal by Watts.

B. Large Demand Systems

1. Sizes 1-1/4" through 2 - ASTM B62 bronze body
2. Sizes 2-1/2" and larger - ASTM A536 ductile iron body
3. Pressure reducing pilot control
4. Stainless steel disc guide, seat and bearing cover
5. Stainless steel stem, nut and spring
6. FDA approved Nylon reinforced Buna-N rubber diaphragm
7. Provide model(s) with size, temperature range, inlet pressure rating, reduced pressure range, outlet pressure and options as scheduled on Contract Drawings.
8. Cla-Val Company Series 90 or approved equal by Watts.

2.9 WATER HAMMER ARRESTORS (SHOCK ABSORBERS):

A. Nesting type bellows operated water hammer arrestor with male N.P.T. connection. Bellows and body casing made of Type 304 stainless steel. Water hammer arrestors shall be certified to the PDI WH-201 Standard and ASSE Standard 1010.

B. Arrestors shall be designed and manufactured for a maximum working temperature of 250F and maximum operating pressure of 125 P.S.I.G.

C. All arrestors shall be designed and approved for sealed wall installation without an access panel.

D. Water hammer arrestors shall be sized according to water hammer arresters standard PDI-WH-201 and as indicated on Contract Drawings.
2.10 WALL HYDRANTS (WH)
   A. Provide antisiphon, non-freeze wall hydrant with brass casing, integral backflow preventer, vandalproof box with loose-key handle and finish as scheduled on Drawings.

2.11 HOSE BIBBS (HB)
   A. General Areas: Provide Chicago Faucet No. 387 chrome plated brass hose bibb with ¾-inch female inlet, wall flange, tee handle and No. E27 vacuum breaker.
   B. Housekeeping Mop Sinks: Provide Chicago Faucet No. 293-369COLDCP chrome plated brass hose bibb with ¾-inch female inlet, wall flange and lever handle.

2.12 TRAP PRIMER UNITS (TP)
   A. Trap Priming devices that rely upon line pressure differential for activation are not allowed.
   B. Trap Primer for use with Lavatory or Sink Drain Tailpiece (Preferred by AISD and should be used whenever possible):
      1. This type of device shall not serve more than one trap.
      2. Polished Chrome Plated Cast Bronze P-trap with Ground Joint Outlet.
      3. Threaded Wall Tube, Slip Joint Nuts, Washers and Escutcheons.
      4. 1/2" Polished Chrome Plated Bronze Primer Tube with Compression Fitting Connection at Wall.
      5. Jay R. Smith Model 2698 or approved equal of a referenced acceptable manufacture.
   C. Electronic Trap Primers:
      1. Provide model with quantity of outlets and type of mounting box as scheduled on Contract Drawings.
      2. The number of traps served by a single trap priming device shall not exceed the number of header outlets provided within the device. Auxiliary distribution units are not allowed.
      3. All unused header outlets shall be capped water-tight with compatible threaded fittings.
      4. Each electronic trap primer device shall be provided with a readily serviceable strainer immediately upstream of the device solenoid valve.
      5. Electronic trap primers shall provide 10 second water injection to traps every twenty-four hours, complete with galvanized steel box and cover, copper inlet connection, brass ball type stop valve, slow closing 24 VAC solenoid valve with integral strainer, 120-24 VAC transformer, brass atmospheric vacuum breaker, and copper waterway.
      6. Electronic trap primers shall be manufactured by Zurn Z1020-CW or approved equal by Precision Plumbing Products "Prime Time", model to suit installation.

2.13 STRAINERS
   A. Strainers, 2" and smaller, bronze body, screwed ends, No. 20 mesh type 304 stainless steel screen, screwed cap with bronze blow-off valve (size to be determined by standard tap size in cap).
   B. Strainers, 2-1/2" and larger, Cast iron body, isolating type flanged ends where installed in copper lines, .125" perforated type 304 stainless steel screen, flanged cap with bronze ball blow-off valve (size of blow-off valve shall be determined by standard tap size in cap).
      Special Note: All strainers 6" and larger shall have studs mounted in the body flange in lieu of bolts for removal of cap. Baskets for strainers 6" and larger shall have stainless steel reinforcing bands at ends to prevent collapsing.

2.14 TEMPERATURE GAUGES:
   A. Thermometers shall be vapor or liquid actuated, direct-mounted, universal adjustable angle dial type with stainless steel or cured polyester powder coated cast aluminum case, stainless steel friction ring and glass window. Dial face shall be white with black figures; pointer shall be friction adjustable type. Movement shall be brass with bronze bushings. Bourdon tube shall be phosphor bronze with a brass socket.
B. Thermometer range shall be 30 - 240° Fahrenheit and have an accuracy of ±1 scale division.
C. Dial face shall be 4½” diameter where installed within eight feet of floor level and 6” diameter where installed higher than six feet above floor level. Provide remote read-out gauges for isolated or hard to access monitoring points.
D. Provide a brass or stainless steel separable thermowell for each thermometer.
E. Thermometers shall have a sensing bulb with an insertion length of roughly half of the pipe diameter; minimum insertion length shall be 2”. Thermometers installed on tanks shall have a minimum insertion length of 5”.
F. Where insulation thickness exceeds 2”, provide proper bulb length and an extension neck separable thermowell. The extension neck shall be at least 2” long.

2.15 PRESSURE GAUGES:
A. Gauges shall comply with ASME B40.1, Grade 2A, and have ±0.5 percent of full scale accuracy, with type 304 stainless steel or aluminum case, bronze wetted parts and brass socket. Dial face shall be 3½” diameter where installed within six feet of floor level and 6” diameter where installed higher than eight feet above floor level. Dial face shall be aluminum with white background, black graduations and black markings. Pointer shall be adjustable with black finish. Provide remote read-out gauges for isolated or hard to access monitoring points.
B. Units of measure shall be in pounds per square inch (psi). The proper range shall be selected so that the average operating pressure falls approximately in the middle of the scale selected.
C. All pressure gauges shall be equipped with brass or stainless steel needle valves and pressure snubbers.

PART 3 - EXECUTION

3.1 PREPARATION
A. Coordinate cutting and forming of roof and floor construction to receive drains with General Contractor.
B. Verify location of equipment and housekeeping pads prior to installation of floor drains. Relocation due to misplacement shall be at Contractor’s expense.

3.2 INSTALLATION
A. General
   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.
   2. Install plumbing specialties in accordance with manufacturer’s published instructions.
B. Drains and Cleanouts
   1. Extreme care shall be used to set the top elevation of floor drains and floor sinks to meet the low point elevation of the finished floor.
   2. Pipe connections to roof drains, above grade floor drains and floor sinks shall not directly contact or be encased in concrete.
   3. Final mounting of interior cleanout top or access cover shall be set flush with the finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil.
   4. Encase exterior cleanouts within 14” x 14” x 6” thick reinforced concrete pad. Set top flush with finished grade surface.
   5. Locate cleanouts with required clearance for rodding of drainage system.
C. Backflow Preventers and Vacuum Breakers
   1. Isolate all non-potable water requirements from the building domestic water system with backflow prevention device manufactured and certified for the particular application.
2. Pipe relief from backflow preventer indirectly to drain of sufficient size to evacuate maximum flow discharge.
3. Backflow preventers shall be duplexed full-size where located within domestic water lines serving in-patient areas, critical research areas, and/or any area or equipment where un-interruptible (24 hour) water service is required.
4. Backflow preventer test ports shall not be located more than 72 inches above finished floor or permanent platform.
5. Do not install vacuum breakers above equipment, above ceilings, concealed within walls, or areas where water leakage can cause damage.

D. Water Hammer Arrestors (Hydraulic Shock Absorbers)-
1. Provide hydraulic shock absorbers in cold and hot water supply lines to each fixture branch, battery of fixtures and at each automatic, solenoid-operated or quick-closing valve serving equipment.
2. Locate and size hydraulic shock absorbers in accordance with PDI-WH-201 Standard and manufacturer’s published recommendations.

E. Water Pressure Regulating Valves
1. Provide isolation valve, strainer and pressure gauge immediately upstream of each pressure regulating valve.
2. Provide pressure gauge and isolation valve immediately downstream of each pressure regulating valve.
3. Installation shall allow sufficient access to and space around components for adjustments and servicing.
4. Provide services of a direct factory representative for start-up service, inspection and necessary adjustments for all large demand regulators.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 & Division 20 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. This section covers the complete first-class natural gas system installation, within and to five (5) feet beyond building perimeter unless noted otherwise on Contract Drawings, including but not limited to piping, regulators, unions, valves, installation, testing and other normal parts that make the systems complete, operable, code compliant and acceptable to the authorities having jurisdiction.

1.3 REFERENCE STANDARDS
A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:
   1. International Fuel Gas Code 2015
   2. Uniform Plumbing Code 2015

1.4 QUALITY ASSURANCE
A. All materials, equipment and Work shall meet or exceed all applicable federal, state and local requirements and conform to codes and ordinances of authorities having jurisdiction.
B. Valves: Manufacturer’s name, size, standards compliance and pressure rating clearly marked on outside of valve body.
C. Welding Materials and Procedures: Conform to ASME Code and applicable state labor regulations.
D. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.
E. Installer Qualifications: Company specializing in performing the Work of this Section with minimum three (3) years documented experience. Installation of natural gas systems shall be performed by individuals licensed by the Texas State Board of Plumbing Examiners as a Journeyman or Master Plumber. All installation shall be supervised by a licensed Master Plumber. All testing shall be performed by a licensed Journeyman or Master Plumber. Welders shall be certified in accordance with ASME Section 9.

1.5 SUBMITTALS
A. Product Data:
   1. Provide code and standards compliance verification, manufacturer’s product data and ratings on pipe materials, pipe fittings, regulators, valves and accessories.
B. Record Documents:
   1. Submit test reports and inspection certification for all natural gas systems installed.
C. Operation and Maintenance Data:
   1. Include installation instructions, spare parts lists, exploded assembly views manufacturer’s recommended maintenance.

1.6 DELIVERY, STORAGE AND HANDLING
A. Accept valves on Site in shipping containers with labeling in place, inspect for damage and store with a minimum of handling. Store plastic piping under cover out of direct sunlight. Do not store materials directly on the ground.
B. Provide temporary protective coating on cast iron and steel valves.
C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work and isolating parts of completed system.

PART 2 - PRODUCTS

2.1 GENERAL
A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
B. Natural gas pressures shall not exceed five (5) pounds per square inch gauge on customer side of the meter.
C. Pipe joint compound shall be lead-free, non-toxic, non-hardening, insoluble in the presence of natural gas and compliant with ANSI/NSF 61 and Federal Specification TT-S-1732. Temperature service range of -15 degrees F to +400 degrees F, manufactured by Hercules “MegaLoc” or approved equal by Rectorseal, La-Co or Oatey.

2.2 PIPING
A. Buried Piping Outside of Building:
   1. Polyethylene, SDR-11, ASTM D2513 pipe and fittings with heat fusion socket joints.
   2. Polyethylene pipe and fitting materials shall be compatible and by same manufacturer to ensure uniform melting and a proper bond. Fabricated fittings shall not be used.
   3. Provide connection between buried plastic gas service piping and metallic riser in accordance with the gas code. Provide metallic riser consisting of HDPE fused coating on steel pipe for connection to above ground building distribution piping. Underground horizontal metallic portion of riser shall be at least twenty four inches in length before connecting to the plastic service pipe. An approved transition fitting or adaptor meeting design pressure rating and plastic pipe manufacturers recommendations shall be used where the plastic joins the metallic riser.
   4. Piping between the building and pump (boiler) house shall be concrete encased or protected with thin layer of concrete.
B. Above Ground Piping Outside of Building (Including roof):
   1. Piping 1½ inches and smaller shall be seamless Schedule 40 black steel, ASTM A106 or ASTM A53 Type "S", Grade A or B, with Class 150 black malleable iron threaded fittings conforming to ASME B16.3.
   2. Piping 2 inches and larger shall be Type "S" seamless or Type "E" electric resistance welded Schedule 40 black steel, ASTM A53, Grade A or B, with Schedule 40 wrought carbon steel fittings, ASTM A 234 and butt weld joints.
   3. Provide factory-applied, three-layer coating of epoxy, adhesive, and PE or field applied primer and epoxy paint coating on all pipe and fittings. Field applied coating is restricted to fittings and short sections of pipe necessarily stripped for threading or
welding. Field coating shall be manufactured by Amercoat Type 240 or approved equal and applied in accordance with manufacturer's recommendations. Galvanizing shall not be considered adequate protection.

C. Above Ground Piping Exposed Inside of Building:
1. Piping 1½ inches and smaller shall be seamless Schedule 40 black steel, ASTM A106 or ASTM A53 Type "S", Grade A or B, with Class 150 black malleable iron threaded fittings conforming to ASME B16.3.
2. Piping 2 inches and larger shall be Type "S" seamless or Type "E" electric resistance welded Schedule 40 black steel, ASTM A53, Grade A or B, with Schedule 40 wrought carbon steel fittings, ASTM A 234 and butt weld joints.
3. EXCEPTIONS:
   a. All exposed piping 1½ inches and smaller located within areas utilized as return air plenums shall have welded joints with Schedule 40 socket welded forged steel fittings conforming to ASME B16.11.

D. Above Ground Piping Concealed Inside of Building (Includes above all ceilings, within partitions, within chases, and all non-accessible locations):
1. Piping 1½ inches and smaller shall be seamless Schedule 40 black steel, ASTM A106 or ASTM A53 Type "S", Grade A or B, with welded joints with Schedule 40 socket welded forged steel fittings conforming to ASME B16.11.
2. Piping 2 inches and larger shall be Type "S" seamless or Type "E" electric resistance welded Schedule 40 black steel, ASTM A53, Grade A or B, with Schedule 40 wrought carbon steel fittings, ASTM A 234 and butt weld joints.
3. EXCEPTIONS:
   a. Threaded piping 1½ inches and smaller may be installed in lieu of welded provided that all piping is encased within steel sleeve vented to the exterior of the building. Sleeve piping shall be Schedule 10 black steel pipe conforming to ASTM A53, Grade A or B, electric resistance welded or seamless, with roll-grooved ends. Sleeve pipe couplings shall be Victaulic Style 75 with Grade T nitrile gasket. Sleeve fittings shall be Victaulic grooved malleable or steel. Sleeve piping and fittings must be two pipe sizes, but not less than 1 inch larger than encased gas piping.

2.3 VALVES

A. All valves shall be designed, manufactured and approved for natural gas service.
B. Line Shut-off Valves sizes 2 inches and smaller shall be iron body lubricated plug valve conforming to ASTM-A-126, U.L. Listed and A.G.A. Approved for natural gas service with threaded ends, wrench operation, rated for 200 WOG service pressure and –20 to 200 degrees F., manufactured by Resun Model R-1430 or Nordstrom Model 142.
C. Line Shut-off Valves sizes 2½ inches and larger shall be iron body lubricated plug valve conforming to ASTM-A-126, U.L. Listed and A.G.A. Approved for natural gas service with flanged ends, wrench operation, rated for 200 WOG service pressure and –20 to 200 degrees F., manufactured by Resun Model R-1431 or Nordstrom Model 143.
D. Appliance/Equipment Shut-off Valves at local connections sizes 2 inches and smaller shall be bronze body, full port ball or butterfly type, U.L. Listed and A.G.A. Approved for natural gas service with threaded ends, quarter turn lever handle operation, rated for 175 W.O.G. service pressure and 30 to 275 degrees F., manufactured by Nibco Model T585-70-UL, Model T580-70-UL or Milwaukee Model BB2-100.
E. Manual Emergency Shut-off Valves sizes 2 inches and smaller shall be bronze body, full port ball or butterfly type, U.L. Listed and A.G.A. Approved for natural gas service with threaded ends, quarter turn lever handle operation, rated for 175 W.O.G. service pressure and 30 to 275 degrees F., manufactured by Nibco Model T585-70-UL, Model T580-70-UL or Milwaukee Model BB2-100.
F. Automatic Emergency Shut-off Valves shall be U.L. Listed F.M. Approved for natural gas service, 2-way electrically tripped solenoid type; fail safe closed; manual reset; Type 1 solenoid enclosure; NBR seals and disc; stainless steel core tube and springs; copper coil; manufactured by ASCO Red Hat Series 8044 or approved equal.

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Cameron, Texas 22 20 23 -3 Natural Gas Piping
2.4 GAS CUTOFFS:
A. On the inlet and discharge side of the meter and pressure regulators and at building entrance, install a wrench operated plug cock valve. The flanges of this stop valve shall be dimensioned, drilled, faced and spot faced to conform to the Class 125 American Standard for Cast Iron Flanges (B16.1-1948). Install zone valves on each floor accessible to occupants for shutting off areas of the building under emergency conditions. Gas piping shall be welded up to these zone valves.

2.5 PRESSURE REGULATORS
A. All pressure regulators shall be designed, manufactured and approved for natural gas service.
B. Pressure regulators for individual service lines shall be capable of reducing distribution line pressure to pressures required for users. Pressure relief shall be set at a lower pressure than would cause unsafe operation of any connected user. Regulator shall have a single port with orifice diameter no greater than that recommended by manufacturer for the maximum gas pressure at the regulator inlet. Regulator vent valve shall be of resilient materials designed to withstand flow conditions when pressed against valve port. Regulator shall be capable of limiting build-up of pressure under no-flow conditions to 50 percent or less of the discharge pressure maintained under flow conditions. Commercial grade diaphragm type with internal relief valve, vent valve, cast iron body, Buna-N diaphragm. Manufactured by Rockwell or Fisher.
C. Install pressure gauge adjacent to and downstream of each line pressure regulator.

2.6 DRIP PIPES:
A. Drip pipes shall be provided throughout the gas piping systems for the purpose of accumulating moisture and condensate. They shall be sized no smaller than the gas piping to which they are connected in each instance. These drip pipes shall be U-shaped providing an effective water seal of no less than twelve inches (12") of water. The extremity of each U-shaped drip pipe shall be threaded and capped with a suitably sized, screwed pattern, black, standard weight, malleable iron cap.
B. All drip pipes shall be located in an accessible position so that the condensate may either be pumped from the system or so that a water seal shall be provided in the event that the water forming the seal evaporates.

2.7 UNIONS
A. Unions in 2 inches and smaller in ferrous lines shall be right and left hand nipple/coupling assembly, or ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends, 2-1/2 inches and larger shall be ground flange unions. Companion flanges on lines at various items of equipment, machines and pieces of apparatus may serve as unions to permit disconnection of piping.
B. Unions connecting ferrous pipe to copper or brass pipe shall be dielectric type.
C. Above grade flexible stainless steel appliance/equipment connectors shall conform with AGA under the ANSI Z21.69 Standard. Hose shall be braided stainless steel with a polyolefin heat-shrink tubing with high flame-retardant qualities. Hose shall be equipped with malleable iron unions and spring loaded brass quick-link couplings. An easily accessible manual shut-off valve shall be installed ahead of all hose connections. Specify T&S Brass “Safe-T-Link” or approved equal.

2.8 HEADERS:
A. The gas distribution header installed by this Contractor in the building shall be fabricated of Schedule 40 steel pipe. The pipe and welding materials for this header shall be carefully selected, and the welding operations shall be carefully supervised.
B. Welding nipples neatly aligned shall be provided for the outlets of the header. After the header has been completely fabricated, it shall be temporarily sealed and subjected to a pneumatic test pressure of 100 pounds per square inch. While the header is subjected to
this pressure, all welded joints shall be given an application of soapy water for the purpose of detecting minute leaks which might not otherwise be observed. These leaks shall not be repaired by any peening operations. Such leaks shall be remedied by chipping and re-welding until the header is devoid of leaks at that pressure. The header shall then be subjected to a hydrostatic test pressure of 200 pounds per square inch. Under these circumstances, the test pressure of the water confined in the header shall not decrease in a four hour period of observation. If leaks are encountered, they shall be repaired and re-tested until proven tight.

C. The header shall be provided with a one-half inch (1/2") drain connection "taken off" the bottom of the header and terminated in a suitable stop cock. This one-half inch (1/2") drain connection shall have its origin in a 2" x 1/2" welding reducer having its two inch (2") end so welded to the header as to completely drain that member. Each outgoing branch from the header shall be provided with a gas stop valve of gas cock. The nature of the outgoing welding nipples shall be such that these cocks shall be aligned in a neat horizontal line.

2.9 FLANGES

A. All 150 lb. and 300 lb. ANSI flanges shall be domestically manufactured, weld neck forged carbon steel, conforming to ANSI B16.5 and ASTM A-181 Grade I or II or A-105-71. Slip on flanges shall not be used. Each fitting shall be stamped as specified by ANSI B16.9 and, in addition, shall have the laboratory control number stenciled on each fitting for ready reference as to physical properties and chemical composition of the material. Complete test reports may be required for any fitting selected at random. Flanges which have been machined, remarked, painted or otherwise produced domestically from imported forges will not be acceptable. Flanges shall have the manufacturer's trademark permanently identified in accordance with MSS SP-25. Contractor shall submit data for firm certifying compliance with these Specifications. Bolts used shall be carbon steel bolts with semi-finished hexagon nuts of American Standard Heavy dimensions. All thread rods will not be an acceptable for flange bolts. Bolts shall have a tensile strength of 60,000 psi and an elastic limit of 30,000 psi. Flat-faced flanges shall be required to match flanges on pumps, check valves, strainers, etc. Only one manufacturer of weld flanges will be approved for each project.

B. All flanges shall be gasketed. Contractor shall place gasket between flanges of flanged joints. Gaskets shall fit within the bolt circle on raised face flanges and shall be full face on flat face flanges. Gaskets shall be cut from 1/16 inch thick, non metallic, non asbestos gasket material suitable for operating temperatures from -150 degrees F to +75 degrees F, Klingersil C-4400, Manville Style 60 service sheet packing, or approved equal.

2.10 UNDERGROUND WARNING TAPE

A. Minimum 3 inch wide polyethylene detectable type marking tape. The tape shall be resistant to alkalis, acids and other destructive agents found in soil and impregnated with metal so that it can be readily recognized after burial by standard locating equipment.
1. Lamination bond of one (1) layer of Minimum 0.35 mils thick aluminum foil between two (2) layers of minimum 4.3 mils thick inert plastic film.
2. Minimum tensile strength: 63 LBS per 3 IN width.
4. Provide continuous yellow with black letter printed message repeated every 16 to 36 inches warning of pipe buried below (e.g.: "CAUTION GAS LINE BURIED BELOW").
5. Manufactured by Reef Industries "Terra Tape" or approved equal.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ream pipe ends and remove cutting burrs. Bevel plain end ferrous pipe.
B. Remove cutting oil, scale and dirt, on inside and outside of piping, before assembly.
3.2 EQUIPMENT CONNECTIONS
A. Provide specified connections, shutoff valves, regulators and unions at each and every appliance and piece of equipment requiring natural gas, including equipment furnished under other Divisions of these Specifications and/or by the Owner.
B. Provide and install union type connections at all equipment to permit removal of service piping.
C. Gas service connections shall have a diameter at least one pipe size larger than that of the inlet connection to the equipment as provided by the manufacturer and be of adequate size to provide the total input demand of the connected equipment.
D. Provide listed and labeled appliance connectors complying with ANSI Z21.69 and listed for use with food service equipment having casters, or that is otherwise subject to movement for cleaning, and other large movable equipment. Connectors shall have listed and labeled quick-disconnect devices and shall have retaining cables attached to structures and equipment. Connectors shall not be concealed within or extended through wall, floor or partition and shall be located entirely in the same room as the connected equipment. Provide an accessible shut-off valve not less than the nominal size of the equipment connector, immediately ahead of the connector.
E. Rigid metallic pipe and fittings shall be used at service connections to all stationary equipment.

3.3 FABRICATION METHODS:
A. All house piping must be securely fastened in place in such a manner as to maintain its grading. Under no circumstances shall extension bars be used for supporting gas piping. Under no circumstances shall any gas piping be used to support any weight other than its own weight.
B. All branch outlet pipes shall be taken from the top or sides of running horizontal lines and not from the bottom. No crosses shall be installed in any horizontal gas line. No unions, gas cocks, or valves shall be used in any concealed location. Every gas cock and valve shall be accessible for inspection and repair.
C. The general arrangement of all gas piping shall be such that the number of threaded joints involved is reduced to an absolute minimum. If obstructions are encountered, pipe shall not be bent to circumvent such obstructions. Welding fittings shall be used for this purpose in the case of welded lines, and if threaded lines are involved, screwed fittings shall be used. Wherever gas pipes run through outside brick, stone, or other walls, the opening around the pipe shall be securely and rigidly sealed. Gas pipe sizes shall be at least one pipe size larger than the inlet of the gas appliance which they supply. No bushings shall be used in conjunction with any gas piping.

3.4 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 manufacturer’s published recommendations.
C. Provide support for and connections to natural gas service meter in accordance with requirements of the utility company.
D. All installation shall be in accordance with manufacturer’s published recommendations.
E. Distribution piping shall be as short and as direct as practicable between the point of delivery and the outlets.
F. All excavation required for plumbing work is the responsibility of the Plumbing Contractor and shall be done in accordance with project Specifications.
G. Do not install underground piping when bedding is wet or frozen.
H. Bury all underground piping at least 3 feet below finished grade. Provide a continuous detectable warning tape on tamped backfill, 12 inches above all buried non-metallic gas lines.
I. Do not install gas piping in the same trench with other utilities. The minimum horizontal clearance between gas pipe and parallel utility pipe shall be 2 feet. Do not install gas pipe through catch basins, vaults, manholes or similar underground structures.
J. Install and support all polyethylene piping in accordance with manufacturer's recommendations. All heat fusion welds shall be performed by welders qualified to the manufacturer’s procedures.

K. Polyethylene piping shall not be installed above ground.

L. Provide connection between buried plastic gas piping and metallic riser in accordance with the gas code.

M. All above ground gas piping shall be electrically continuous and bonded to electrical system ground conductor in accordance with NFPA 70.

N. Provide and install union type fittings at proper points to permit dismantling or removal of pipe. No unions will be required in welded lines except at equipment connections. Where union type fittings are necessary for piping dismantling purposes, right and left nipples and couplings shall be used. Flanges, ground-joint unions or approved flexible appliance connectors may be used at exposed fixture, appliance or equipment connections.

O. Provide dielectric isolation device where copper lines connect to ferrous lines or equipment, such as dielectric coupling or dielectric flange fitting.

P. Valves, regulators, flanges, union type fittings and similar appurtenances shall be accessible for operation and servicing and shall not be located above ceilings, within chases, walls/partitions, spaces utilized as return air plenums or non-accessible locations.

Q. Route piping in orderly manner and maintain gradient. Install piping to conserve building space. Group piping whenever practical at common elevations.

R. Install piping to allow for expansion and Contraction without stressing pipe, joints, or connected equipment.

S. Make service connections at the top of the main, whenever the depth of the main is sufficient to allow top connections. When service connections cannot be made at the top of the main, they shall be made on the side of the main no lower than the horizontal midpoint of the gas main.

T. Cross type fittings shall not be installed in any gas line. Bushings shall not be used in conjunction with any gas piping.

U. Slope piping and arrange to drain at low points. Install drip/sediment traps at points where condensate and debris may collect. Locate drip/sediment traps where readily accessible for cleaning and emptying. Do not install where condensate would be subject to freezing. Construct drip/sediment traps using tee fitting with capped nipple connected to bottom outlet. Use minimum-length nipple of 3 pipe diameters, but not less than 4 inches long, and same size as connected pipe. Cap shall be screwed pattern, black, standard weight, malleable iron. Install with adequate space for removal of cap.

V. Install valves for shut off and to isolate equipment, parts of systems, or vertical risers. All valves shall be located such that servicing and operation is possible. All flanged valves shown in horizontal lines with the valve stem shall be positioned so that the valve stem is inclined one bolt hole above the horizontal position. Screw pattern valves placed in horizontal lines shall be installed with their valve stems inclined at an angle of a minimum of 30 degrees above the horizontal position. All valves must be true and straight at the time the system is tested and inspected for final acceptance. Valves shall be installed as nearly as possible to the locations indicated in the Contract Drawings. Any change in valve location must be so indicated on the Record Drawings.

W. Install line shut-off valve at each branch connection to riser. Branch line shut-off valves shall be automatic type where indicated on Drawings.

X. Provide adequate clearance for access to and operation of all valves.

Y. Install valves with stems upright or horizontal, not inverted unless required otherwise by the valve manufacturer.

Z. Pipe vents from gas pressure reducing valves and pipe casing sleeves to the exterior of the building and terminated with outlet turned down and capped with corrosion resistant insect screen. Vent terminations shall be at least seven feet above grade or pedestrian traffic and a minimum three (3) feet above or twenty five (25) feet horizontally from all air intakes or building openings.

AA. Above ground horizontal natural gas and encasement piping shall be supported at intervals of no greater than 6 foot for 1/2 inch piping, 8 foot for 3/4 inch and 1 inch piping and 10 foot for 1-1/4 inches and larger piping. Vertical piping shall be supported at each floor level and at intervals as specified for horizontal piping.
BB. Extension bars shall not be used for supporting gas or encasement piping. Gas or encasement piping shall not be used to support any other piping or component.

CC. Identify piping and valves in accordance with Project Specification Section 20 05 53.

3.5 INSTALLATION OF WELDED PIPING

A. Welding of pipe in normally occupied buildings is prohibited. Off-Site welding is acceptable. Should welding be required in a normally occupied building for connecting to an existing welded system, obtain written approval from the Resident Construction Manager and comply with Owner’s fire and life safety requirements.

B. Piping and fittings shall be welded and fabricated in accordance with ASME/ANSI the latest editions of Standard B32.1 for all systems from the Code for Pressure Piping. Machine beveling in shop is preferred. Field beveling may be done by flame cutting to recognized standards.

C. Ensure complete penetration of deposited metal with base metal. Provide filler metal suitable for use with base metal. Maintain inside of fittings free from globules of weld metal. All welded pipe joints shall be made by the fusion welding process, employing a metallic arc or gas welding process. All pipes shall have the ends beveled 37-1/2 inch degrees and all joints shall be aligned true before welding. Except as specified otherwise, all changes in direction, intersection of lines, reduction in pipe size and the like shall be made with factory-fabricated welding fittings. Mitering of pipe to form elbows, notching of straight runs to form tees, or any similar construction will not be permitted.

D. Align piping and equipment so that no part is offset more than 1/16 inch. Set all fittings and joints square and true and preserve alignment during welding operation. Use of alignment rods inside pipe is prohibited.

E. Contractor shall not permit any weld to project within the pipe so as to restrict it. Tack welds, if used, must be of the same material and made by the same procedure as the completed weld. Otherwise, remove tack welded during welding operation.

F. Do not split, bend, flatten or otherwise damage piping before, during or after installation.

G. Remove dirt, scale and other foreign matter from the inside of piping, by swabbing or flushing, prior to the connection of other piping sections, fittings, valves or equipment.

H. In no cases shall Schedule 40 pipe be welded with less than three passes including one stringer/root, one filler and one lacer. Schedule 80 pipe shall be welded with not less than four passes including one stringer/root, two filler and one lacer. In all cases, however, the weld must be filled before the cap weld is added.

I. Weld Testing:
   1. All welds are subject to inspection, visual and/or x-ray, for compliance with Specifications. The Owner will at the Owner’s option, provide employees or employ a testing laboratory for the purposes of performing said inspections and/or x-ray testing. Initial visual and x-ray inspections will be provided by the Owner. The Contractor shall be responsible for all labor, material and travel expenses involved in the re-inspection and retesting of any welds found to be unacceptable. In addition, the Contractor shall be responsible for the costs involved in any and all additional testing required or recommended by ASME/ANSI Standards B31.1 and B31.3 due to the discovery of poor, unacceptable or rejected welds.
   2. Welds lacking penetration, containing excessive porosity or cracks, or are found to be unacceptable for any reason, must be removed and replaced with an original quality weld as specified herein. All qualifying tests, welding and stress relieving procedures shall, moreover, be in accord with Standard Qualification for Welding Procedures, Welders and Welding Operators, Appendix A, Section 6 of the Code, current edition.

3.6 TESTING

A. All natural gas systems shall be inspected, tested, purged and placed into operation in accordance with NFPA 54 and as required herein.

B. All natural gas piping systems shall be very carefully inspected, tested, purged and placed into operation by a Licensed Plumber.

C. All necessary apparatus for conducting tests shall be furnished by the Contractor and
comply with the requirements of NFPA 54.

D. All new rough-in distribution piping and affected portions of existing systems connected to, shall be subjected to a pneumatic test pressure utilizing clean, dry air and must be demonstrated to be absolutely tight when subjected to the pressures and time durations listed herein. All equipment and components designed for operating pressures of less than the test pressure shall not be connected to the piping system during test.

1. Systems on which the normal operating pressure is less than 0.5 pounds per square inch gauge (psig), the test pressure shall be 5.0 psig and the time interval shall be 30 minutes.

2. Systems on which the normal operating pressure is between 0.5 psig and 5.0 psig, the test pressure shall be 1.5 times the normal operating pressure or 5.0 psig, whichever is greater, and the time interval shall be 30 minutes.

3. Systems on which the normal operating pressure is 5.0 psig or greater, the test pressure shall be 1.5 times the normal operating pressure, and the time interval shall be one (1) hour.

E. After testing is complete, the entire gas system shall be purged with dry nitrogen to eliminate all air, debris and moisture from the piping before natural gas is introduced into the system.

F. After successful results of pressure test and purging have been completed, a leakage test shall be performed in accordance with NFPA 54 Appendix D.

G. Connect, inspect and purge gas utilization equipment, lab hook-ups, outlets, etc., and place into operation only after successful results of pressure test, leakage test and purging have been completed and accepted.

H. In all instances in which leaks are then found, they shall be eliminated in the manner designated by the Owner’s duly authorized representative. Testing operations shall be repeated until gas-piping systems are absolutely tight at the pneumatic test pressures indicated above.

I. The Contractor shall make all arrangements to assure that AHJ Inspectors view the final test and that a certificate is provided from the Inspectors verifying that the installation meets requirements.

J. Pressure test gas piping sleeve system with clean, dry compressed air at 15 psig by temporarily sealing all openings between gas carrier pipe and sleeve and vent openings. Sleeve systems must be demonstrated to be absolutely tight when subjected to this pressure for a period of four hours.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary
   Conditions and Division 01 & Division 20 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. This section covers providing all labor and materials for the complete first class installation of
   point-of-use electric storage (6 - 50 gallon) tank type domestic water heaters indicated and
   scheduled on Contract Drawings complete with all controls, piping, valves, wiring, supports,
   accessories, testing, and other normal parts required for complete, code compliant, operable
   installation that is acceptable to the authorities having jurisdiction.

1.3 REFERENCE STANDARDS
A. The latest published edition of a reference shall be applicable to this Project unless identified
   by a specific edition date.
B. All reference amendments adopted prior to the effective date of this Contract shall be
   applicable to this Project.
C. All materials, installation and workmanship shall comply with the applicable requirements
   and standards addressed within the following references:
   1. 2015 Edition of the Uniform Plumbing Code
   2. Underwriters Laboratories Listings

1.4 QUALITY ASSURANCE
A. Heaters shall be designed to limit the maximum temperature to avoid scalding.
B. Manufacturer Qualifications: Company shall have minimum three years documented
   experience specializing in manufacturing the products specified in this section.
C. Provide equipment with manufacturer's name, model number, and rating/capacity
   permanently identified.
D. Water heater shall meet or exceed the minimum energy factor requirements of ASHRAE
   Standard 90.1 -2013.
E. Installer Qualifications: Company shall have minimum three years documented experience
   specializing in performing the Work of this section. Installation of plumbing systems shall be
   performed by individuals licensed by the Texas State Board of Plumbing Examiners as a
   Journeyman or Master Plumber. Installation may be performed by Apprentice Plumbers
   provided they are registered with the Texas State Board of Plumbing examiners and under
   direct supervision of a licensed plumber. All installation shall be supervised by a licensed
   Master Plumber.
F. Products and installation of specified products shall be in conformance with
   recommendations and requirements of the following:
   1. National Sanitation Foundation (NSF).
   3. UL Standard 1453 or UL Standard 174 - Electric Booster and Commercial Storage
      Tank Water Heaters.

1.5 SUBMITTALS
A. Product Data:
Milam County Annex
Cameron, Texas 22 33 33 -1 Electric Water Heaters
1. Include dimension Drawings of water heaters indicating piping, components and required connections.
2. Manufacturer's data sheets, wiring diagrams and Installation Instructions.
3. Provide complete description of equipment materials, electrical characteristics, options provided, warranty, maximum water pressure requirements and code compliance.

B. Record Documents:
   1. Provide full written description of manufacturer's warranty.

C. Operation and Maintenance Data:
   1. Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

1.6 DELIVERY, STORAGE AND HANDLING
A. Accept products on Site in factory packaging. Inspect for damage. Maintain products in factory packaging until installation.
B. Provide temporary inlet and outlet caps when not factory provided. Maintain caps in place until installation.
C. Protect components from damage after installation.
D. Do not allow use of heater for any reason, other than testing, during the construction phase of this project.

1.7 WARRANTY
A. The manufacturer shall provide a three-year warranty in writing against tank leaks caused by corrosion and one-year parts warranty against operational failure due to faulty manufacturing or materials.
B. The complete system shall be warranted in writing against defects in materials or workmanship under normal use and service for a period of one year after date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL
A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

2.2 POINT OF USE DOMESTIC WATER HEATER
A. Acceptable manufacturers
   1. State
   2. Rheem
   3. A.O. Smith
   4. All electric point-of-use storage tank type water heaters provided within this project shall be the product of one manufacturer.
B. Furnish and domestic hot water heaters with dimensions, capacities and electrical characteristics as scheduled on the Contract Drawings and as outlined herein. This Specification describes minimum quality and performance requirements. Variations of system components by the individual referenced manufacturers are acceptable for installation in this project provided they meet or exceed all of the requirements indicated herein, are compatible with the electrical service provided and fit properly in the allocated space.
C. Heater shall have 150 psi working pressure and be equipped with extruded high density anode rod. All internal surfaces of the heater exposed to water shall be glass-lined with an alkaline borosilicate composition that has been fused to steel by firing at a temperature range of 1600°F.
D. Direct-Immersion threaded electric heating elements heating elements shall be medium watt density with zinc plated copper sheath. Each element shall be controlled by an individually mounted thermostat and high temperature cutoff switch. Heaters having double-elements shall be provided with simultaneous wiring to permit both elements to operate at the same time.

E. The heater outer jacket shall be of baked enamel finish and shall be provided with full size control compartment for performance of service and maintenance through hinged front panels and shall enclose the tank with foam insulation.

F. Water heater shall have a properly sized, factory provided temperature and pressure relief valve.

G. The tank drain valve shall be located in the front for ease of servicing.

2.3 VACUUM RELIEF VALVES

A. Construction shall be bronze body with silicone disc having a dry guide which is located out of the water. Unit shall open at less than 1/2” vacuum and be suitable for use within a system having a maximum water pressure of 200 psi and a maximum temperature of 250°F. Vacuum relief valves shall be in compliance with the appropriate requirements of ANSI Z21.22.

B. Vacuum relief valves shall be manufactured by Watts Regulator, Wilkins or Conbraco.

PART 3 - EXECUTION

3.1 PREPARATION

A. Provide 4” high reinforced concrete housekeeping pad beneath floor mounted water heaters or provide heater with legs/base manufactured by heater manufacturer.

3.2 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 manufacturer’s published recommendations.

C. Install water heaters, piping, wiring and accessories in accordance with the manufacturer’s installation instructions.

D. Furnish all supports required by the equipment included in this Contract in accordance with the manufacturer’s published instructions.

E. Each water heater located above ceiling or at any location where leakage would result in damage to the building or its contents shall be provided with and set within a safety pan equipped with a minimum ¾ inch drain connection. Safety pans shall be minimum 24 gauge galvanized sheet metal and be three inches larger on all sides than the water heater, with a minimum depth of two inches.

F. Connect and extend copper piping from pan drain connection and temperature and pressure relief valve and discharge separately to the exterior of the building and terminate between 6 and 24 inches above grade at a visible location that cannot cause damage to property or personnel. Relief valve shall not discharge into safety pan.

G. Safety pan and relief valve drain lines shall be copper and installed so that all water will drain completely out of the piping. Where it is impractical or physically impossible to extend a drain line to the building exterior, drain lines shall discharge separately into a floor drain, housekeeping mop sink or other location approved by the AHJ building inspector.

H. Each water heater shall be provided with clear access and unobstructed passageway that is adequate to allow removal and replacement.

I. Install heater in a vertical position with a clearance on all sides for servicing. Coordinate location of unit to avoid conflicts with other system or building components.

J. Furnish and install all necessary valves, strainers, unions, etc. to facilitate proper functioning and servicing of equipment.

K. Provide dielectric isolation device where copper lines connect to ferrous lines or equipment.

L. Install an accessible line size shutoff valve in cold water inlet within two feet of heater.
M. Provide heat trap inlet piping for storage type heaters to prevent migration of heated water into cold water system.
N. Provide heat trap in outlet piping for storage type heaters serving non-circulated distribution systems.
O. Provide a vacuum relief valve in cold water supply to heaters having bottom feed inlet. Install valve in accordance with manufacturer's recommendations.
P. Provide a temperature gauge in the outlet piping adjacent to storage type heaters. Locate gauge in an easily readable position.
Q. Flush water supply line to remove all air, scale and dirt prior to connecting heater.
R. Take precautions to prevent heat generated by soldering procedures from being transmitted to heater components.
S. Coordinate with Electrical Contractor for power and wiring required. Verify that electrical power is connected to a properly grounded dedicated branch circuit of proper voltage rating and equipped with ground fault interrupter. Each heater shall be provided with an independent circuit. Insure that the correct wire and circuit breaker sizes are provided.
T. When all plumbing installation is completed, check for leaks and take corrective action before proceeding. Flow hot water until temperature has stabilized. Verify and insure that the water meets scheduled temperature at all outlets. Clean heater water prior to final inspection of installation.

3.3 TRAINING
A. Contractor shall instruct and acquaint the Owner with the proper functioning, operation and maintenance of the water heater and all associated installed components.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 & Division 20 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. Perform all Work required to provide and install a complete variable frequency motor drive (VFD) consisting of a pulse width modulated (PWM) inverter designed for use on a standard NEMA Design B induction motor.
B. The drive manufacturer shall supply the drive and all necessary controls as specified.

1.3 REFERENCE STANDARDS
A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:
   2. ANSI/UL Standard UL508C, Underwriter’s Laboratories.
   3. ICS 7.0, AC Adjustable Speed Drives, National Electrical Manufacturer’s Association (NEMA).
   4. IEC 16800 Parts 1 and 2.

1.4 QUALITY ASSURANCE
A. Company specializing in manufacturing the products specified in this Section with minimum three (3) years experience.
B. VFD and options shall be UL listed as a complete assembly. VFD’s that require the customer to supply external fuses are not acceptable.
C. VFD and options shall be tested to ANSI/UL Standard 508 and listed by a nationally recognized testing agency such as UL or ETL.
D. VFD and options shall comply with applicable requirements of the latest Standards of ANSI/UL, IEEE, and the NEC.

1.5 SUBMITTALS
A. Product Data:
1. Submit product data for components and accessories.

2. All VFD’s for this Project shall be supplied by one manufacturer.

3. Submit Shop Drawings indicating outline dimensions, enclosure construction, lifting and supporting points, electrical one-line diagram, equipment electrical ratings, noise levels (including driven equipment) and total harmonic distortion (voltage and current).

4. Manufacturer shall provide terminal block to terminal block wiring diagrams coordinated with the Owner to provide a complete and functional operating system. Furnish detailed Drawings showing construction, dimensions, wiring diagrams, and installation procedures for Engineer’s approval.

B. Operation and Maintenance Data:

1. Submit manufacturer’s written installation instructions.

2. Submit training outline.

3. Furnish harmonic analysis verifying compliance with specified distortion levels.

4. Furnish a list of recommended spare parts.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products to the Project Site under provisions of Division 01 and Division 20.

B. Accept products on Site in factory-fabricated protective container with factory installed shipping skids and lifting lugs. Inspect for damage.

C. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures and finish.

1.7 EXTRA MATERIALS

A. Submit two insulated-handle tools designed for pulling fuses in accordance with ANSI/IEEE C37.46.

B. Refer to Section 26 28 13 for fuse requirements.

1.8 WARRANTY

A. VFD shall be unconditionally warranted by the manufacturer for Five (5) years from the date of Substantial Completion.

B. Warranty shall include all parts, labor, shipping, field service or technician time, labor or travel expenses, and verbal or written correspondence with the VFD manufacturer or VFD manufacturer’s representatives. Include correspondence which might be incidental to the proper installation and operation of the equipment.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
B. Furnish complete VFD controllers that convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of three-phase AC motors. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for centrifugal pump and fan control and to eliminate the need for motor derating.

C. Contractor shall check equipment schedules on the Contract Drawings to determine if the VFD “bypass” switch option is required to allow the motor to run if the controller malfunctions.

D. VFD manufacturer shall verify compatibility of motor furnished on equipment. One controller shall control the speed of one motor with the exception being a wall fan technology system.

E. VFD shall convert 3 phase, 60 Hz utility power to adjustable voltage and frequency, 3 phase AC power for stepless motor speed control from 10 percent to 100 percent of the motor’s 60 Hz speed. Input voltage characteristics are 480 volts, 3 phase, 60 Hz.

F. VFD shall include a converter section. The converter section shall convert fixed frequency and voltage AC utility power to a variable DC voltage. VFD’s that use silicon controlled rectifiers in the converter bridge shall also include 5 percent reactors. Isolation transformers are not acceptable in lieu of line reactors.

G. VFD shall include an inverter section. The inverter section shall invert the variable DC voltage into a PWM wave form; adjustable voltage and frequency output for stepless motor speed control.

H. Individual or simultaneous operation of VFD’s shall not add more than 5 percent total harmonic voltage distortion and no more than 5 percent total harmonic current distortion (per IEEE 516-1992) to the normal bus.
   1. VFD manufacturer shall perform harmonic analysis based on the electrical one-line diagram.
   2. The VFD manufacturer shall provide calculations specific to this installation, showing total harmonic voltage distortion is less than 5 percent.
   3. Input line filters shall be sized and provided as required by the VFD manufacturer to ensure compliance with IEEE Standard 519. All VFD’s shall include a minimum of 5 percent impedance reactors, no exceptions.

I. VFD shall include a coordinated AC transient protection system consisting of 4-120 joule rated MOV’s (phase to phase and phase to ground), a capacitor clamp, and 5 percent impedance reactors.

J. Alternate Harmonics Specification:
   1. Input line reactors and DC Bus filtered chokes (factory installed and wired in the drive enclosure) shall be provided to allow reliable operation on a typical commercial power distribution system and to minimize harmonics reflected onto the input line.
      a. Shall not interfere with computer and other electronic systems in the building.
      b. If not inherently protected, provide a suitable isolation transformer.
      c. The system shall not produce spikes on the incoming line.
   2. Any inverter that generates sufficient electrical line noise to interfere with operation of sensitive building equipment shall be field modified or replaced by the inverter supplier at no additional cost to the Owner.
K. EMI / RFI filters. All VFD’s shall include EMI/RFI filters. The onboard filters shall allow the VFD assembly to be CE Marked and the VFD shall meet product Standard EN 61800-3 for the First Environment restricted level.

L. Low voltage logic and 115V control circuits shall be electrically isolated from the power circuits. Signal circuit common shall be grounded.

M. VFD shall include a power ride-through feature to allow continuous operation up to a three-cycle line loss.

N. Two independently adjustable accel and decel ramps with 1 to 1800 seconds adjustable time ramps. Extended time periods are also acceptable.

O. VFD shall have full function output current limit adjustable from 10 to 100 percent. At the factory with compatible motor, provide at least three lock-out ranges (50 rpm maximum each), two of which can be used to correct any run test problems.

P. Components shall be pretested and complete VFD shall have full burn-in under full load for a minimum of 12 hours. Provide at least three lockout ranges (50 rpm maximum), two of which can be used to correct run test problems.

Q. Ambient noise generated by the VFD shall be limited to an amount equal to the system noise level as designated by the latest ASHRAE noise level guidelines for such equipment at each octave band. Noise level criteria at different octave bands and mid-frequencies shall be furnished with the submittal data.

R. VFD shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and audible motor noise.

2.2 MANUFACTURERS
   A. Yaskawa Electric (Design Basis).
   B. ABB. (Accepted Alternate)

2.3 ENCLOSURE
   A. VFD shall be enclosed in a UL Listed Type 12 enclosure. Enclosure shall be UL listed as a plenum rated VFD. The VFD tolerated voltage window shall allow operation from a line of +30 percent nominal, and -35 percent nominal voltage as a minimum.

   B. Environmental operating conditions: 0 to 40 degrees C continuous. VFD’s that can operate at 40 degrees C intermittently (during a 24-hour period) are not acceptable and must be oversized. Altitude from 0 to 3300 feet above sea level, less than 95 percent humidity, non-condensing. VFD’s without these ratings are not acceptable.

   C. The following operator controls shall be located on the front of the enclosure:
      2. Drive mode selector.
      3. Bypass mode selector.
      5. Provide the following indicating lights (LED type). In addition, provide test mode or push to test feature:
         a. Power-on (ready).
b. Run enable (safeties) open.
c. Drive mode select damper opening.
d. Bypass mode selected.
e. Drive running.
f. Bypass running.
g. Drive fault.
h. Bypass fault.
i. Bypass H-O-A mode.
j. Automatic transfer to bypass selected.
k. Safety open.
l. Damper opening.
m. Damper end-switch made.

6. Provide the following relay (form C) outputs from the bypass:
   a. System started.
   b. System running.
   c. Bypass override enabled.
   d. Drive Fault.
   e. Bypass fault (motor overload or underload-broken belt).

D. Digital inputs for the system shall accept 24V or 115VAC (selectable).

E. Customer Interlock Terminal Strip: Provide a separate terminal strip for connection of freeze, fire, smoke contacts, and external start command. All external safety interlocks shall remain fully functional whether the system is in Hand, Auto, or Bypass modes (not functional in fireman’s override 2). The remote start/stop contact shall operate in VFD mode.

F. Dedicated digital input that will transfer motor from VFD mode to bypass mode upon dry contact closure for fireman’s override. Two modes of operation are required:

1. The first mode forces the motor to bypass operation and overrides both the VFD and bypass H-O-A switches and forces the motor to operate across the line (test mode). The system will only respond to the digital inputs and motor protections.

2. The second mode operates as the first, but will also defeat the overload and single-phase protection for bypass and ignore all keypad and digital inputs t he system run until destruction).
G. Include a “run permissive circuit” that will provide a normally open contact whenever a run command is provided (local or remote start command in VFD or bypass mode). The VFD system (VFD or bypass) shall not operate the motor until it receives a dry contact closure from a damper or valve end-switch. When the VFD system safety interlock (fire detector, freeze stat, high static pressure switch, etc) opens, the motor shall coast to a stop and the run permissive contact shall open, closing the damper or valve.

H. Include Class 20 or 30 (selectable) electronic motor overload protection.

2.4 BYPASS

A. Furnish where indicated on the Drawings, a complete factory wired and tested bypass system consisting of an output contactor and bypass contactor. Overload protection shall be provided in both drive and bypass modes.

B. Bypass to be furnished, built, and mounted by the VFD manufacturer.

C. Provide an internal switch to select manual or automatic bypass.

D. Provide an adjustable current sensing circuit for the bypass to provide loss of load indication (broken belt) when in the bypass mode.

E. Door interlocked, disconnect that will disconnect all input power from the drive and all internally mounted options.

F. Fused VFD only disconnect (service switch). Fast acting fuses exclusive to the VFD – fast acting fuses allow the VFD to disconnect from the line prior to clearing upstream branch circuit protection, maintaining bypass capability. Bypass designs, which have no such fuses, or that incorporate fuses common to both the VFD and the bypass will not be accepted. The following contactor bypass schemes are not acceptable.

1. Door interlocked main input disconnect switch.

2. Power on light.


G. The bypass shall incorporate an internally sourced power supply and shall not require an external power source.

2.5 DISPLAY / KEYPAD

A. All applicable operating values shall be capable of being displayed in engineering (user) units. A minimum of three (3) operating values from the list below shall be capable of being displayed at all times. The display shall be in complete English words (alpha-numeric codes are not acceptable):

1. Output frequency.
2. Motor speed (RPM, percent, or engineering units).
5. Calculated motor power (kW).
6. DC bus voltage.
7. Output voltage.
B. Keypad shall include a backlit LCD display. The display shall be in complete English words for programming and fault diagnostics (alpha-numeric codes are not acceptable). The keypad shall use the following assistants:

1. Start-up assistants.
2. Parameter assistants.
3. Maintenance assistant.
4. Troubleshooting assistant.

C. VFD shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. Keypad shall be removable, capable of remote mounting and shall allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFD’s.

D. Keypad shall include Hand-Off-Auto selections and manual speed control. The drive shall incorporate “bumpless transfer” of speed reference when switching between “Hand” and “Auto” modes. There shall be fault reset and “Help” buttons on the keypad. The Help button shall include “on-line” assistance for programming and troubleshooting.

E. Provide a built-in time clock with battery back-up in the VFD keypad. The time clock shall be used to date and time stamp faults and record operating parameters at the time of fault. If the battery fails, the VFD shall automatically revert to hours of operation since initial power up. The time clock shall also be programmable to control start/stop functions, constant speeds, PID parameter sets and output relays. The VFD shall have a digital input that allows an override to the time clock (when in the off mode) for a programmable time frame. There shall be four (4) separate, independent timer functions that have both weekday and weekend settings.

2.6 SERIAL COMMUNICATION

A. VFD shall have the capability of communicating with the building automation system (BAS) via an RS-485 serial port and BACnet interface.

B. VFD shall be provided with protocol information specific to the selected BAS Provider and shall be pre-configured at the factory to provide automatic communications without the need for field programming.

C. VFD shall continue to provide serial communications regardless of how inverter is being controlled (“manual” mode via keypad, “automatic” mode via BAS, or “stopped” mode via either keypad or automatic BAS start/stop signal).

D. Serial communications capabilities shall include, but not be limited to:

1. Run/stop control speed set adjustment.
2. Proportional/integral or PID control adjustments.
4. Accel/decel time adjustments.

E. VFD shall have the capability of allowing the BAS to monitor the following feedback signals:

1. Process variable.
2. Output speed/frequency.
4. Torque.
5. Power (kW).
6. Operating hours.
7. Kilowatt hours (kWh).
8. Relay outputs.
9. Diagnostic warning and fault information.

F. VFD shall allow the BAS to control the drive’s digital and analog outputs and monitor all drive digital and analog inputs via the serial interface.

G. VFD shall be capable of providing the BAS with status signals for bypass operation and external safety trips via serial interface.

2.7 SYSTEM OPERATION

A. Selector switch in the "off" position: controller run circuit shall be open and the system shall not operate.

B. Selector switch in the "manual" position: motor speed shall be controlled by the manual speed potentiometer.

C. Selector switch in the "auto" position: operation shall be via input 0 to 10 VDC or 4-20 mA signal with strategy output speed proportional to the input signal. If required into the controls strategy, VFD manufacturer shall furnish a pressure transducer mounted in the drive enclosure to convert a 3 to 15 psi pressure signal to a 0 to 10 VDC signal or 4-20 mA signal.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that surfaces are ready to receive Work.

B. Verify that field measurements are as shown on Shop Drawings and as instructed by manufacturer.

C. Verify that required utilities are available, in the proper location, and ready for use.

3.2 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 manufacturer’s published recommendations.

C. Power wiring shall be completed by the Electrical Contractor in accordance with the recommendations of the VFD manufacturer as outlined in the installation manual.

3.3 TESTING

A. Manufacturer shall provide a factory trained technician to inspect, test and start-up the VFD and associated equipment and place the VFD into operation.

B. A harmonic test verifying the distortion level shall be included as part of Start-up and forwarded to the Owner. Any additional equipment, installation and equipment floor space required to meet the distortion level as set forth in the Specification, shall be borne by the VFD manufacturer.

3.4 TRAINING

A. Manufacturer shall provide for and present to the Owner, at no cost to the Owner, a training and troubleshooting course at the Owner’s location.
1. Provide one (1) hour orientation/start-up operation training for a minimum of two (2) people.

END OF SECTION
SECTION 23 05 93

SYSTEM TEST AND BALANCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 & Division 20 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. Testing, adjusting, and balancing (TAB) of the air conditioning systems and related ancillary equipment will be performed by a technically qualified TAB Firm.
   B. TAB Firm shall be capable of performing the TAB services as specified in accordance with the Contract Documents, including the preparation and submittal of a detailed report of the actual TAB Work performed.
   C. TAB Firm shall check, adjust, and balance components of the air conditioning system which will result in optimal noise, temperature, and airflow conditions in the conditioned spaces of the building while the system equipment is operating economically and efficiently. This is intended to be accomplished after the system components are installed and operating as specified in the Contract Documents. It is the responsibility of the Contractor to place the equipment into service. Variable air volume systems shall be balanced in accordance with AABC Standard, Latest Edition or NEBB Standards for Testing, Adjusting, Balancing of Environmental Systems (Latest Edition).
   D. TAB Firm shall check, adjust, and balance all hydronic systems including pumps, water distribution systems, chillers, cooling towers, boilers, heat exchangers, coils, and related equipment.
   E. Liaison and Early Field Inspection:
      1. TAB Firm shall act as a liaison between the Owner, Architect and Contractor. TAB Firm shall perform the following reviews (observations) and tests:
         a. During construction, review all HVAC submittals such as control diagrams, air handling devices, etc., that pertain to the ability to satisfactorily balance systems.
         b. Test at least one or at least 25 percent of the single and fan-powered terminal units if the number of units are greater then twenty (20), for casing and damper leakage when the shipment arrives at the Project Site. All testing (except for the initial terminal units) shall be performed at the Project Site.
         c. Test one (1) lab configuration including fume hood with air valve, general exhaust air with air valve and supply air with air valve for performance capability through a full range of inlet pressures. The tracking capability of the exhaust air versus the supply air will be with the submitted hood sash fully open and as the sash is closed in 2 inch increments until fully closed. Track the valves' response time in relation to sash movement and the lab differential.
2. During the balancing process, as the TAB Firm discovers abnormalities and malfunctions of equipment or components, the TAB Firm shall advise the Contractor in writing so that the condition can be corrected by the Contractor prior to finishing the TAB scope of Work. Data from malfunctioning equipment shall not be recorded in the final TAB report.

1.3 REFERENCE STANDARDS
A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:
5. CTI - Cooling Technology Institute CODE ATC-105.

1.4 QUALITY ASSURANCE
A. TAB Firm shall have operated a minimum of five (5) years under TAB Firm’s current name and shall be in good standing with the State of Texas, Franchise Tax Board. TAB Firm shall submit full incorporated name, Charter Number, and Taxpayer’s I.D. Number for proper verification of TAB Firm’s status.
B. TAB Firm’s personnel performing Work at the Project Site shall be either professional engineers or certified air and water balance technicians, who shall have been permanent, full time employees of the TAB Firm for a minimum of six (6) months prior to the start of Work for this Project.
C. TAB firm shall have a background record of at least five (5) years of specialized experience in the field of air and hydronic system balancing and shall possess properly calibrated instrumentation.

1.5 SUBMITTALS
A. Submit a design document review report, and a separate field observation report prior to installation of insulation. Identify issues that need correction in order to balance.
B. The activities described in this Section shall culminate in a report to be provided in quadruplicate (4), individually bound and also provided electronically to the Contractor to be presented to the Owner. Neatly type and arrange data. Include with the data, the dates tested, personnel present, weather conditions, nameplate record of test instrument and list all measurements taken after all corrections are made to the system. Record all failures and corrective action taken to remedy incorrect situation. The intent of the report is to provide a reference of actual operating conditions for the Owner’s operations personnel.
C. All measurements and recorded readings (of air, water, electricity, etc.) that appear in the report must have been made at the Project Site by the permanently employed technicians or engineers of the TAB Firm.

D. At the Owner’s option, all data sheets tabulated each day by TAB Firm personnel shall be submitted for review and sign-off by the Owner’s Construction Inspector. Those data sheets, as initialed by Owner’s Construction Inspector, shall be presented as a supplement to the final TAB report.

E. Submit reports on electronic forms approved by the Owner and Architect/Engineer which will include the following information 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. Instrument List:
   b. Manufacturer.
   c. Model.
   d. Serial number.
   e. Range.
   f. Calibration date.
   g. What test instrument was used for.

3. Fan Data (Supply and Exhaust):
   a. Identification and 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.

4. Air Handler Return Air/Outside Air Data (If fans are used, provide fan data as noted above):
   a. Identification and location.
   b. Design return air flow.
   c. Actual return air flow.
   d. Design outside air flow.
   e. Return air temperature.
   f. Outside air temperature.
   g. Required mixed air temperature.
   h. Actual mixed air temperature.

5. Electric Motors:
   a. Manufacturer.
   b. Horsepower/brake horsepower.
   c. Phase, voltage, amperage, nameplate, actual.
   d. RPM.
   e. Service factor.
   f. Starter size, heater elements, rating.

6. V-Belt Drive:
   a. Identification and location.
   b. Required driven RPM.
   c. Driven sheave, diameter and RPM.
   d. Belt, size and quantity.
   e. Motor sheave, diameter and RPM.
   f. Center-to-center distance, maximum, minimum and actual.

7. 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 temperature.
j. Air correction factor.

8. Air Monitoring Station Data:
   a. Identification and location.
   b. System.
   c. Size.
   d. Area.
   e. Design velocity.
   f. Design air flow.
   g. Test velocity.
   h. Test air flow.

9. Variable or Constant Volume Terminal Unit Test Sheet:
   a. Identification number.
   b. Room number/location.
   c. Terminal type (FP if fan powered) and / or (SDVV, SDCV, DDVV, DDCV), and HWRH.
   d. Terminal size.
   e. Area factor.
   f. Design velocity.
   g. Design maximum and minimum air flow.
   h. Test (final) velocity.
   i. Test (final) maximum and minimum air flow.
   j. For DDC instrumentation: Measure and record computer readout and calibration factor at the final measurement conditions.
   k. Air dry bulb temperature at the discharge of the terminal unit.

10. Pump Data:
    a. Identification and location.
    b. Manufacturer.
c. Size/model.
d. Impeller size.
e. Service (CTW, CHW, CDW, HW, etc.).
f. Developed head pressure and BHP at design flow rate.
g. Developed head pressure and BHP at actual flow rate.
h. Pump discharge pressure.
i. Pump suction pressure.
j. Total operating head pressure at final balance.
k. Shut off, discharge and suction pressure.
l. Shut off, total head pressure.
m. Pressure differential settings.
n. Fluid temperature.

11. 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 quantity CFM design, and CFM actual.
n. Air pressure drop, design and actual.
o. Sensible Btu/hr design, and actual.
p. Total Btu/hr design, and actual.

12. Heating Coil Data:
   a. Identification number.
b. Location.
c. Service.
d. Manufacturer.
e. Air flow, design and actual.
f. Water flow (gpm) or Steam mass flow rate (lbs per hour) design and actual.
g. Pressure drop water (feet w.g.) or steam (psid), design and actual.
h. Entering water or steam temperature, design and actual.
i. Leaving water or steam temperature, design and actual.
j. Entering air temperature, design and actual.
k. Leaving air temperature, design and actual.
l. Air quantity CFM design, and CFM actual.
m. Air pressure drop, design and actual.
n. Sensible Btu/hr design, and actual.
o. Electric heat kW, number of stages, kW per stage – specified and actual (if applicable).

13. Heat Exchanger Data:
   a. Identification and location.
   b. Service.
   c. Manufacturer.
   d. Steam flow rate, design and actual.
   e. Water flow rate, design and actual.
   f. Water pressure drop, design and actual.
   g. Entering steam temperature and pressure, design and actual.
   h. Entering water temperature, design and actual.
   i. Leaving water temperature, design and actual.
   j. Electric heat, full load kW, number of stages, kW per stage – specified and actual (if applicable).

14. Chiller:
   a. Identification and location.
   b. Manufacturer and model number.
   c. Condenser cooling medium (water or air cooled).
   d. Number of compressor types and number of stages.
e. Chilled water entering and leaving temperature - specified and actual - one hour log.

f. Condenser water entering and leaving temperature - specified and actual - one hour log.

g. Evaporator section and condenser section water side pressure drop - specified and actual.

h. Air cooled condenser entering and leaving dry bulb temperatures.

i. Compressors full load amperage - specified and actual.

j. Voltage, phase, and cycle - specified and actual.

k. Ambient temperature, DB/WB, time of day, and weather conditions at time of test.

l. Cooler tons, condenser tons, and measured operating kW / ton compared to factory certified performance test data.

15. Cooling Tower:

a. Identification and location.

b. Manufacturer.

c. Model number.

d. Size and serial number.

e. Motor horsepower and RPM.

f. Voltage, phase, hertz.

g. Full load amps.

h. Running amps.

i. Cooling tower water flow rate through the tower.

j. Cooling water flow rate through the bypass piping.

k. Air entering and leaving wet bulb temperatures.

l. Record airflow velocities and rates at the tower air inlets.

m. Specified and actual tons capacity at design conditions.

16. Hot Water Boiler or Steam Boiler:

a. Identification and location.

b. Unit manufacturer and model number.

c. Heating water flow gpm - specified and actual (if applicable).

d. Steam capacity lbs per hour - specified and actual (if applicable).

e. Steam temperature and pressure - specified and actual.

f. MBtuh Input / output - specified and actual.
g. MBtuh output - specified and actual.

h. Gas / Fuel oil burner CFH / gpm.

i. Gas / Fuel oil inlet pressure, in water / psig.

j. Blower motor horsepower and FLA.

k. Fire rate - gas, therm. / oil, btu per lbm.

l. High fire set point(s).

m. Low fire set point(s).

n. NOx measurement (based on capacity of boiler per the Texas Commission on Environmental Quality).

17. Sound Level Report:
   a. Location (Location established by the Engineer).
   b. Baseline background NC curve for eight (8) bands – with equipment off.
   c. Operating NC curve for eight (8) bands – with equipment on.

18. Vibration Test on equipment having 10 horsepower motors or greater:
   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 outlet).
      9) Duct after flexible connection (suction inlet).

   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).
19. Control verification indicating date performed and any abnormalities identified:
   a. Point Location/Description.
   b. EMS Readout (Setpoint and Actual).
   c. Actual Readout.
   d. Interlocks.
   e. Safeties:
      1) VSD Normal Operation.
      2) VSD Bypass Operation.
   f. Alarms.
   g. Sequences of Operation.

20. Include in the appendix all submittals for air handling units, pumps, fans, heat exchangers, energy recovery units control system, etc.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 AIR BALANCE

A. When systems are installed and ready for operation, the TAB Firm shall perform an air balance for all air systems and record the results. The outside, supply, exhaust and return air volume for each air handling unit, supply fan and exhaust fan and the supply, exhaust or return air volume for each distribution device shall be adjusted to within +/- 5 percent of the value shown on the Drawings. Air handling unit and fan volumes shall be adjusted by changing fan speed and adjusting volume dampers associated with the unit. Air distribution device volume shall be adjusted using the spin-in tap damper for flexible duct connected devices and the device opposed blade damper (OBD) for duct connected devices. Air distribution devices shall be balanced with air patterns as specified. Duct volume dampers shall be adjusted to provide air volume to branch ducts where such dampers are shown.

B. The general scope of balancing by the TAB Firm shall include, but is not limited to, the following:

1. Filters: Check air filters and filter media and balance only systems with essentially clean filters and filter media. The Contractor shall install new filters and filter media prior to the final air balance.

2. Blower Speed: Measure RPM at each fan or blower to design requirements. Where a speed adjustment is required, the Contractor shall make any required changes.

3. Ampere Readings: Measure and record full load amperes for motors.

4. Static Pressure: Static pressure gains or losses shall be measured across each supply fan, cooling coil, heating coil, return air fan, air handling unit filter and exhaust fan. These readings shall be measured and recorded for this report at the furthest air device or terminal unit from the air handler supplying that device. Static pressure readings shall also be provided for systems, which do not perform as designed.
5. Equipment Air Flow: Adjust and record exhaust, return, outside and supply air CFM(s) and temperatures, as applicable, at each fan, blower and coil.

6. Coil Temperatures: Set controls for full cooling and for full heating loads. Read and record entering and leaving dry bulb and wet bulb temperatures (cooling only) at each cooling coil, heating coil and reheat coil at each VAV terminal unit. At the time of reading record water flow and entering and leaving water temperatures (In variable flow systems adjust the water flow to design for all the above readings).

7. Zone Air Flow: Adjust each HVAC VAV terminal unit and VAV air handling unit for design CFM.

8. Outlet Air Flow: Adjust each exhaust inlet and supply diffuser, register and grille to within + 5 percent of design air CFM. Include all terminal points of air supply and all points of exhaust. Note: For Labs and rooms that are negative exhaust air flow shall be set to design + 10 percent and supply to design - 5 percent. Positive areas will have opposite tolerances.

9. Pitot Tube Traverses: For use in future troubleshooting by Owner, all exhaust ducts, main supply ducts and return ducts shall have air velocity and volume measured and recorded by the traverse method. Locations of these traverse test stations shall be described on the sheet containing the data.

10. Maximum and minimum air flow on terminal units.

3.2 HYDRONIC SYSTEM BALANCE

A. When systems are installed and ready for operation, the TAB Firm shall perform water balance for each chilled and heating hot water system.

B. The general scope of balancing by the TAB Firm shall include, but not be limited to, the following:

1. Adjusted System Tests: Adjust balancing valves at each coil and heat exchanger for design flow, +/- 5 percent. Adjust balancing valves at pumps to obtain design water flow. Record pressure rise across pumps and GPM flow from pump curve. Permanently mark the balanced position for each valve. (Note: If discharge valves on the pumps are used for balancing record the head being restricted by the valves).

2. Temperature Readings: Read and record entering and leaving water temperature at each water coil, converter and heat exchanger. Adjust as necessary to design conditions. Provide final readings at all thermometer well locations.

3. Test cooling towers in accordance with CTI Code ATC – 105.

4. Pressure Readings: Water pressure shall be recorded at all gauge connections. Pressure readings at coils and pumps shall be related to coil and pump curves in terms of GPM flow through flow measuring status, if provided and installed, at each air handler. The flow of water through all water coils shall be adjusted by manipulating valves until the rated pressure drops across each coil is obtained and total water flow is verified by flow measuring status. For coils equipped with 3-way valves, the rated pressure drop shall first be adjusted through the coils. The bypass valve shall then be adjusted on each coil until an equal pressure drop between supply and return connections is the same as with the flow through the coil.

5. Ampere Readings: Reading and record full load amperes for each pump motor.
3.3 SOUND VIBRATION AND ALIGNMENT
A. Sound: Read and record sound levels at up to fifteen (15) locations per floor in the building as designated by the Architect/Engineer. All measurements shall be made using an Octave Band Analyzer. All tests shall be conducted when the building is quiet and in the presence of the Architect/Engineer, at the Architect/Engineer’s option.

B. Vibration: Read and record vibration for all water circulating pumps, air handling units, and fans which have motors larger than 10 horsepower. Include equipment vibration, bearing housing vibration, foundation vibration, building structure vibration, and other tests as directed by the Architect/Engineer. Readings will be made using portable IRD (or approved equal) equipment capable of filtering out various unwanted frequencies and standard reporting forms. Maximum vibration at any point listed above, or specified, shall not exceed one mil on fans and one mil on pumps unless otherwise specified. Equipment manufacturer shall rectify all systems exceeding vibration tolerances.

3.4 BUILDING AUTOMATION SYSTEMS
A. In the process of performing the TAB Work, the Contractor shall:
   1. Work with the Building Automation System (BAS) Provider and Owner to ensure the most effective total system operation within the design limitations, and to obtain mutual understanding of intended control performance.
   2. Verify that all control devices are properly connected.
   3. Verify that the intended controllers operate all dampers, valves and other controlled devices.
   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 all duct-mounted dampers, dampers in terminal units, and fire/smoke dampers.
   6. Observe that all valves are properly installed in the piping system in relation to direction of flow and location.
   7. Observe the calibration and operation 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 locations of all sensors to determine whether their position will allow them to sense only the intended temperatures or pressures of the media. BAS Provider will relocate sensors as deemed necessary by the TAB Firm or Contractor.
  11. Verify that the sequence of operation for any control mode is in accordance with approved Shop Drawings and Specifications. Verify that no demand for simultaneous heating and cooling occurs at the terminal units.
  12. Verify that all controller setpoints meet the Contract Documents.
  13. Check all dampers for free travel.
  14. Verify the operation of all interlock systems.
15. Perform variable volume system verification to assure the system and system components track with changes from full flow to minimum flow.

END OF SECTION
SECTION 23 09 23
DIRECT DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 DIRECT DIGITAL CONTROL (DDC) SYSTEM DESCRIPTION
A. Intent. This Contractor shall supply and install a complete Direct Digital Control (DDC) system as required to accomplish the specified sequences of operation for control of heating, ventilating, air-conditioning and other building equipment and systems as described herein.

1.2 DDC SYSTEM REQUIREMENTS
A. BACnet®. The control system shall consist of a high-speed, peer-to-peer internetwork of ANSI/ASHRAE 135 native BACnet® DDC devices. The control system shall also incorporate input/output devices, mechanical/electrical automatic temperature control devices, enclosures, interconnecting conduit and cabling.
   1. The BACnet® operating stack must be embedded directly in each individual DDC device at the media access controller level and in all operator interface and configuration applications.
   2. Communication gateways, bridges, protocol translators or any other device that translates any proprietary communication protocol to BACnet® shall not be permitted as a part of the DDC system provided pursuant with this specification except as required to communicate to existing building systems.
B. BTL. All DDC devices shall be tested, certified, clearly stamped and listed by the BACnet® Testing Laboratories (BTL) prior to the bid date for this project. BTL product listings are available from BACnet® International (http://www.bacnetinternational.net/btl/).
C. Modularity. The DDC system shall be modular in nature and implemented in such a manner that it can be expanded in both capacity and functionality through the addition of DDC controllers, devices and wiring.
D. Local Database. All logic required to perform the specified sequences of operation, trending and alarming as outlined in this specification shall reside in each individual DDC device. Should network communications fail, each device shall be capable of performing local control strategies without reliance upon any other device.
   1. DDC devices that require any supervisory server software or hardware or any external platform to manage database execution or network management shall not be permitted as a part of the DDC system provided pursuant with this specification.
E. Web. The DDC system shall be accessible through a web front end with no other software required to view graphical representations or make changes to the schedule/ setpoints.

1.3 DDC SYSTEM ARCHITECTURE
A. BACnet®. The DDC system as provided and installed under this specification shall comprise a BACnet® Internetwork. All communication shall conform to ANSI/ASHRAE Standard 135, BACnet®.
B. Consistency. The DDC system as provided and installed under this specification shall be a complete system from a single manufacturer designed for use on intranets and the Internet.
1.4 CODES AND STANDARDS

A. Workmanship, materials and equipment together with the resultant complete and operational DDC System shall be in compliance with the Authorities Having Jurisdiction (AHJ) for the project and the most restrictive of applicable local, state and federal codes and ordinances in cooperation with these plans and specifications. At a minimum, the installation shall comply with the applicable sections of the current editions in effect thirty (30) days prior to receipt of bids of the following codes:

1. ANSI/ASHRAE Standard 135: BACnet® - A Data Communication Protocol for Building Automation and Control Networks
2. National Electric Code (NEC)
3. Underwriters Laboratories (UL)
   a. UL-916 – Energy Management Systems (EMS)

1.5 SYSTEM PERFORMANCE

A. Graphic Display. A minimum of 50 dynamic real-time data points within 10 seconds of the request and shall refresh with current data within 5 seconds.
B. Program Execution. All programs in all DDC devices shall be able to execute at a minimum of at least one time every second. Program execution time shall be configurable to be consistent with the process under control.
C. Environmental Conditions. All DDC System components provided under this specification shall operate under ambient environmental conditions of -20°C (-4°F) to 55°C (131°F) dry-bulb and 10% to 90% relative humidity, non-condensing as a minimum. Sensors and control elements shall be constructed of material suitable and rated for the media sensed under the ambient environmental temperature, pressure, humidity, and vibration conditions encountered for the installed location.
D. Power Conditions. Networked components of the DDC System shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80%.
E. Reporting Accuracy. System shall report values with minimum end-to-end accuracy as listed in Table 1.
F. Control Stability and Accuracy. Control applications shall maintain process variables at setpoint within the tolerances listed in Table 2.

1. Combined system repeatability of sensors, controllers and readout devices for a particular application shall be plus or minus 2% of full scale of the operating range.

<table>
<thead>
<tr>
<th>PROCESS VARIABLE</th>
<th>REPORTING ACCURACY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space Temperature</td>
<td>±0.5°C (±1.0°F)</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>±3% RH</td>
</tr>
<tr>
<td>Ducted Air Temperature</td>
<td>±1.0°C (±2.0°F)</td>
</tr>
<tr>
<td>Outdoor Air Temperature</td>
<td>±1.0°C (±2.0°F)</td>
</tr>
<tr>
<td>Outside Air Flow Measurement</td>
<td>±2.0% (0-5000FPM)</td>
</tr>
<tr>
<td>Air pressure (space)</td>
<td>±3 Pa (±0.01 in. WG)</td>
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</table>
### TABLE 2: CONTROL STABILITY & ACCURACY

<table>
<thead>
<tr>
<th>PROCESS VARIABLE</th>
<th>CONTROL ACCURACY</th>
<th>RANGE OF MEDIUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space Temperature</td>
<td>±1.0°C (±2.0°F)</td>
<td></td>
</tr>
<tr>
<td>Space Humidity</td>
<td>±6% RH</td>
<td></td>
</tr>
<tr>
<td>Outside Air Flow</td>
<td>±200 CFM</td>
<td></td>
</tr>
<tr>
<td>Space Pressure</td>
<td>±25 Pa (±0.1 in. WG)</td>
<td></td>
</tr>
</tbody>
</table>

1.6 SUBMITTALS

A. Submit in compliance with all General Conditions of the Contract, Supplementary Conditions and General Requirements of the project and in conjunction with the requirements of this section.

B. No work may begin on any segment of this project until submittals have been successfully reviewed for conformity with the design intent.

C. All submittals and documentation including complete DDC System engineering design submittal & drawings, project record documents, application engineering documents and owner’s & maintenance manuals shall be submitted electronically in the form of an ISO 32000 Portable Document Format (PDF). All control schematics, wiring diagrams, riser diagrams, etc. shall be formatted for A3 paper size (297mm x 420mm, 11” x 17”). All other documentation may be formatted for A4 (210mm x 297mm, 8.5” x 11”).

1.7 WARRANTY

A. The DDC System Manufacturer shall warranty all DDC controllers to be free of defect in material and workmanship under normal operation and expected service as published by the manufacturer in the unit’s performance specifications for a period of five (5) years at a minimum.

1. Sensors and field components integral to DDC controllers shall be warrantied to be free of defect in material and workmanship under normal operation and expected service as published by the manufacturer in the unit’s performance specifications for a period of one (1) years at a minimum.

B. The DDC System Contractor shall warranty the installation of all other DDC materials and labor to be free of defects under normal expected service and use for a period of one (1) year from the date of final acceptance.

C. DDC System failures during the installation warranty period shall be adjusted, repaired or replaced at no additional cost or reduction in service to the Owner. Except in the event of property loss or damage, warranty service shall be provided during regular working hours Monday through Friday.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The order of manufacturers does not indicate preference. Inclusion on this list does not guarantee acceptance of products or installation. DDC Systems shall comply with all of the requirements of this specification.

B. The following are approved DDC System manufacturers and product lines:

1. Reliable Controls® by Enviromatic Systems

2.2 ACCEPTABLE AIRFLOW MONITORING MANUFACTURERS

A. DDC Systems shall comply with all of the requirements of this specification.

B. The following are approved Airflow Monitoring System manufacturers and product lines:
1. Ebtron- Gold Series or approved equal

2.3 COMMUNICATION
A. Wireless communication will not be allowed.
B. The DDC system as provided and installed under this specification shall comprise a BACnet® Internetwork. All communication shall conform to ANSI/ASHRAE Standard 135, BACnet®.
C. Each individual DDC device shall provide a communication port for the connection of an operator workstation.
D. All DDC System BACnet® networked devices with Real-Time Clocks (RTCs) shall utilize the BACnet® Time Synchronization service. The System shall automatically synchronize system clocks from a designated Time Master periodically via the Internetwork. The System shall also automatically adjust for configurable Daylight Savings Time and Standard Time as applicable.

2.4 NETWORK SECURITY
A. B/VPN. All BACnet internetwork communication between separate broadcast domains shall be required to be secured using a BACnet Virtual Private Network (B/VPN) WITH 256-bit encryption.
1. All B/VPN communication must utilize standard BACnet services on Transport Layer Protocol (TCP). All B/VPN data must be encrypted using TLS and secured using authenticated credentials. B/VPN must be provisioned to support custom encryption keys and authentication certificates.
2. All BACnet communication to and from any discrete host(s), including remote Workstations and Servers, etc. external to the Local Area Network (LAN) shall be required to be secured using a B/VPN.
3. All BACnet communication between separate LANs shall be required to be secured using a B/VPN.
4. All BACnet communication exposed to the Internet shall be required to be secured using a B/VPN.
5. Only BACnet communication that is transmitted exclusively on trusted, Local Area Networks (LANs) shall not be required to be secured using a B/VPN.
6. The B/VPN shall support static or dynamic IP addresses including assignments from a Domain Name System (DNS) or Dynamic Host Configuration Protocol (DHCP) server.
7. The B/VPN clients shall not require “inbound” connections through the LAN firewall. Nor shall B/VPN clients require the configuration of any port-forwarding from external ports through the firewall to the LAN.

2.5 EMBEDDED BACNET® OPERATOR WORKSTATION (B-OWS)
A. Each operator shall be required to log on to the system with a unique user name and password in order to view, edit, add or delete data through a web based front end.
1. System security permissions shall be multilayered and defined for each individual operator to restrict/permit day-to-day operations and system configuration.
2. An administrator-level operator shall have the ability to configure credentials for all other operators.
3. Each operator shall be automatically logged-off of the system after a configurable period of inactivity.
B. Graphical User Interface (GUI). The operator interface shall be graphically oriented.
1. All color graphic displays shall be dynamic with current point data automatically updated from the BACnet® internetwork to the workstation without operator intervention.
C. Scheduling. The workstation shall support viewing and with proper user credentials, modification, creation and deletion of binary, analog and multistate BACnet® Schedule objects and parameters.
1. The schedule objects shall reside in each individual device. Workstation or server-based scheduling shall not be acceptable.

D. Trend Logs. The workstation shall support both the BACnet® Trend Log and the BACnet® Trend Log Multiple standard objects for defining custom trend logs for any object in the system. This definition shall include interval, length, start time and end time.
1. The trend data shall be sampled and stored in each individual BACnet® device where the object is stored. The workstation or another field level integration platform shall not be required for storage of custom trend logs.

2.6 CONTROLLERS
A. Specification Compliance. All DDC controllers shall comply with the general requirements of all parts of this specification.
B. Application. Each individual mechanical system or piece of equipment shall be controlled by no more than one (1) dedicated controller with sufficient hardware and database capacity such that it shall be connected to all field devices and sensors associated with that system and/or piece of equipment.
1. Distributed control of one (1) single piece of mechanical equipment shall not be performed by multiple controllers.
C. Memory. Each controller shall have sufficient memory to support its operating system, database, and programming requirements. Battery/capacitor shall maintain programming and clock memory and functions for a minimum of 72 hours.
1. Each controller shall provide microprocessor based self-contained stand-alone fully programmable operation of local process control loops. All local level application programs shall be installed on individual controllers in non-volatile memory.
D. Updates. All controllers shall permit simple operating system firmware updates at any time after installation, utilizing the BACnet® network. Operating system firmware that requires chip replacement or flash modification will not be acceptable.

2.7 WIRELESS TEMPERATURE SENSORS
A. Wireless communication will not be allowed.

2.8 CURRENT SWITCHES
A. Current Switches. Current-operated switches shall be UL-Listed self-powered, solid-state, split-core type with adjustable trip current, status LED and dry-contact output.

2.9 RELAYS
A. Control Relays. Control relays shall be UL-Listed, enclosed with LED energized indicator. Contact rating, configuration and coil voltage shall be suitable for application. Coil current shall be less than 50 mA.

PART 3 - EXECUTION

3.1 GENERAL
A. The DDC System, all of its components, its execution and compliance with this specification is the responsibility of the DDC System Contractor. All control system components shall be installed in locations as required to properly sense the controlled medium and perform according to the intent of the specified sequence of operations and the requirements of the contract drawings and this specification.
B. Unless specified otherwise, all DDC System devices and components as required to appropriately satisfy the intent of the specified sequence of operations and the requirements of the contract drawings and this specification shall be provided as a part of this section.
C. Training. Provide two (4) hour sessions of on-site or classroom training sessions throughout the contract period for personnel designated by the Owner.
   1. Provide one (4) hour session of training immediately following demonstration and acceptance.
   2. Provide one (4) hour session of training at 6 months following demonstration and acceptance.

3.2 GRAPHICAL INTERFACE REQUIREMENTS
   A. DDC System shall have a main landing page that lists all buildings within the customers portfolio.

3.3 GENERAL WORKMANSHIP
   A. DDC System installation shall be performed by professionals in a workmanlike manner consistent with acceptable industry standards for performance and in compliance with the contract documents, Project Electrical System Specifications, the National Electric Code (NEC), CSA C22.1-12 and any/all applicable local codes and/or Authorities Having Jurisdiction (AHJ).

3.4 IDENTIFICATION OF HARDWARE AND WIRING
   A. All wiring and cabling, including that within factory-fabricated panels shall be labelled at each end within 5 cm (2") of the termination with the description or termination number.
   B. All labels and identifiers shall match record documents.

3.5 CONTROL ACCEPTANCE AND DEMONSTRATION
   A. Prior to acceptance, the DDC System shall undergo a series of performance tests to verify proper operation and compliance with this specification.
   B. The tests described in this section are in addition and subsequent to the tests necessary for start-up, tuning, debugging and compliance with the requirements of the Check-out and Testing section of this specification. The Engineer or an appointed representative shall be present at the tests specified in this section and shall be notified ten (10) working days prior to the testing procedures.

END OF SECTION
SECTION 23 21 13
HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 & Division 20 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. Furnish and install all labor, materials, equipment, tools and services and perform all the operations required in connection with, or associated with, the construction of complete hydronic piping systems, including chilled and heating hot water piping, condenser water piping process chilled or hot water piping and condensate drain piping systems as indicated on the Drawings.

1.3 REFERENCE STANDARDS
A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:
   1. ANSI/ASME Sec 9 - Welding and Brazing Qualifications.
   3. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings Class 150 and 300.
   5. ANSI/ASME B16.23 – Cast Copper Alloy Solder Drainage Fitting – DWV.
   6. ANSI/ASME B16.29 – Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings – DWV.
   7. ANSI/ASME B31.9 - Building Services Piping.
   8. ASME B36.1 – Standardization of dimensions of welded and seamless wrought steel pipe for high or low temperatures and pressures.
   10. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated (Galvanized), Welded and Seamless, for Ordinary Uses.
   12. ASTM A106 Grade B, Seamless or Electric Resistance Welded (ERW) piping.
   13. ASTM A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.

1.4 QUALITY ASSURANCE
A. Valves: Manufacturer's name and pressure rating shall be clearly marked on the outside of the valve body.
B. All grooved joint couplings, fittings, flanges, valves, and specialties of the same type shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
C. Welding Materials and Procedures: Conform to Chapter V, ASME/ANSI B31.9 and applicable state labor regulations.
E. Each threaded fitting shall be stamped as specified by ANSI B16.3.
F. Each welded fitting shall be stamped as specified by ANSI B31.9.

1.5 SUBMITTALS
A. Product Data:
   1. Submit product data on pipe materials, pipe fittings, valves, and accessories. Clearly indicate make, model, type, size, and pressure rating for each device.
   2. Submittal data for all fittings shall include a letter signed by an official of the manufacturing company certifying compliance with these Specifications.
B. Welding certificates.
C. Operation and Maintenance Data: For air control devices, hydronic specialties, and special duty valves to include in emergency, operation, and maintenance manuals.
D. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.
E. Record Documents:
   1. Grooved joint couplings and fittings (only in mechanical room) shall be shown on drawings and product submittals and shall be specifically identified with the applicable Victaulic style or series designation.
   2. Include welder’s certification of compliance in accordance with Chapter V, ASME/ANSI B31.9.

PART 2 - PRODUCTS

2.1 GENERAL
A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
B. Wall, Floor and Ceiling Plates:
   1. Provide chrome-plated brass floor and ceiling plates.
C. Threaded Fittings:
   1. All threaded fittings shall be USA factory made, wrought carbon or alloy steel threaded fittings conforming to ASTM A234 or malleable iron threaded fittings conforming to ASME B16.3.
   2. Acceptable manufacturers: Grinnell, Tube Turn, Weld Bend Hackney, Taylor Forge or Ladish Company.
D. Grooved Fittings (only in mechanical room):
   1. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components. Fittings shall comply with ASTM A536; ASTM A234; or factory fabricated from carbon steel pipe conforming to ASTM A53.
   3. Gaskets shall be verified as suitable for the intended system service, a minimum temperature of 250 degrees, fluid chemistry, and system pressure prior to installation. Gaskets shall be molded and produced by the coupling manufacturer.
E. Welded Fittings:
   1. All welded fittings shall be USA factory made wrought carbon steel butt welding fittings conforming to ASTM Spec. A234 or ASME B16.9.
   2. Acceptable manufacturers: Grinnell, Tube Turn, Weld Burn Hackney, Taylor forge or Ladish Company.
F. Flanges:
   1. All 150 lb. and 300 lb. ANSI flanges shall be weld neck and shall be domestically manufactured, forged carbon steel, conforming to ANSI B16.5 and ASTM A-191 Grade I or II or A-105 as made by Tube Turn, Hackney or Ladish Company. Slip on flanges shall not be used. Complete test reports may be required for any fitting selected at random.
2. Flanges shall have the manufacturer’s trademark permanently identified in accordance with MSS SP-25. Contractor shall submit data for firm certifying compliance with these Specifications.

3. Bolts used shall be carbon steel bolts with semi-finished hexagon nuts of American Standard Heavy dimensions. All-thread rods will not be an acceptable substitute for flange bolts. Bolts shall have a tensile strength of 60,000 psi and an elastic limit of 30,000 psi.

4. All flanges shall be gasketed. Place gasket between flanges of flanged joints. Gaskets shall fit within the bolt circle on raised face flanges and shall be full face on flat face flanges. Gaskets shall be cut from 1/16 inch thick, non-metallic, non-asbestos gasket material suitable for operating temperatures from -150 degrees F to +750 degrees F, Klingerseal C-4400, Manville Style 60 service sheet packing or accepted substitution. Gaskets must be compatible with flowing fluid, temperature, and pressure of system.

G. Copper Fittings:
1. Mechanically formed, drilled and extruded tee-branch connections shall not be permitted.

2.2 PIPE

A. Building Chilled Water and Heating Water Piping – 150 psi System:
1. Steel:
   a. Pipe 2-1/2 inches and smaller: Black steel ASTM A53, Grade A or B, seamless, Schedule 40.
      1) Fittings: Screwed, AAR malleable iron, Class 150.
      2) Joints: Screwed.
      3) Unions: Forged steel, ASTM A105, screwed with stainless steel seats.
   b. Pipe 3 inches and larger: Black steel ASTM A53, Grade B, seamless:
      1) 3 inches through 6 inches – Schedule 40.
      2) 8 inches through 16 inches – Schedule 30.
      3) 18 inches through 20 inches – 0.375 inch wall thickness.
      4) 24 inches – 0.562 inch wall thickness.
      5) Fittings:
         a) ASTM A234 carbon steel welding type, long radius type elbows unless specified otherwise on the Drawings.
         b) ASTM A536 ductile iron; A234 carbon steel; or factory fabricated A53; grooved end long radius type elbows (only in mechanical room) unless specified otherwise on the Drawings.
      6) Joints:
         a) Butt welded.
         b) Grooved mechanical couplings (only in mechanical room).
      7) Flange: ANSI B16.5 Class 150, forged carbon steel.

2. Copper:
   a. Pipe 2-1/2 inches and smaller; Copper Tubing: ASTM B 88, Type L, hard drawn. All brass and bronze piping components shall have no more than 15 percent zinc content.
      1) Fittings: ASME B16.18, cast bronze, or ASME B16.22 wrought copper and bronze.
      2) Joints: ASTM B 32, solder, Grade 95TA (lead free).
   b. Pipe over 2-1/2 inches: Copper Tubing: ASTM B88, Type K, hard drawn. All brass and bronze piping components shall have no more than 15 percent zinc content.
      1) Fittings: ASME B16.18, cast bronze or ASME B16.22, wrought copper and bronze.

B. Fluid Cooler Condenser Water Piping:
1. Pipe: Black steel, ASTM A53, Grade B:
   a. 3 inches through 6 inches – Schedule 40.
   b. 8 inches through 18 inches – Schedule 30.
   c. 20 inches and larger – 0.500 inch thickness.
2. Fittings:
   a. ASTM A234 carbon steel welding type.
   b. ASTM A536 ductile iron; A234 carbon steel; or factory fabricated A53; grooved end type (only in mechanical room).
3. Joints:
   a. Butt welded.
   b. Grooved mechanical couplings (only in outdoor or mechanical room).
5. Coat exterior condenser water pipe, valves, and fittings, with minimum 8 mil thick coal tar epoxy.

C. Equipment Drains and Overflows:
   a. Fittings: Galvanized cast iron, ductile iron, steel, or ATM B16.3 malleable iron.
   b. Joints: Screwed, or grooved mechanical couplings.
2. Tubing: Copper ASTM B88, Type L, hard drawn.
   b. Joints: ASTM B32, solder, Grade 95TA or grooved mechanical couplings (only in mechanical room).

D. Cooling Coil Condensate Recovery:
   a. Fittings: Galvanized cast iron, ductile iron, steel, or ATM B16.3 malleable iron.
   b. Joints: Screwed, or grooved mechanical couplings.
2. Tubing: Copper ASTM B88, Type L, hard drawn.
   b. Joints: ASTM B32, solder, Grade 95TA or grooved mechanical couplings (only in mechanical room).

2.3 GROOVED MECHANICAL COUPLINGS AND FITTINGS (ONLY IN MECHANICAL ROOM)
A. Grooved mechanical couplings shall consist of two ductile iron housing segments conforming to ASTM A536, with pressure responsive elastomer gasket, and zinc electroplated carbon steel bolts and nuts.
1. Sizes 2-1/2 inches through 8 inches:
   a. Rigid Type Couplings: Housings cast with offsetting, angle-pattern bolt pads to provide rigidity and system support and hanging in accordance with ANSI B31.1 and B31.9. Victaulic Style 107 Quick-Vic™.
   b. Flexible Type Couplings: Use in locations where vibration attenuation and stress relief are required. Victaulic Style 77 or 177 Quick-Vic™.
   c. Flange Adapters: Flat face, for direct connection to ANSI Class 125 or 150 flanged components. Victaulic Style 741.
2. Sizes 10 inches through 12 inches:
   a. Rigid Type Couplings: Housings cast with offsetting, angle-pattern bolt pads to provide rigidity and system support and hanging in accordance with ANSI B31.1 and B31.9. Victaulic Style 07.
   b. Flexible Type Couplings: Use in locations where vibration attenuation and stress relief are required. Victaulic Style 77.
   c. Flange Adapters: Flat face, for direct connection to ANSI Class 125 or 150 flanged components. Victaulic Style 741.
3. Sizes 14 inches through 24 inches: AGS 'W' series couplings shall include a widened gasket and wide profile housings.
   a. Rigid Type Couplings: Housing key with lead-in chamfer, with key designed to fill the wedge shaped AGS groove to provide rigidity and system support and hanging in accordance with ANSI B31.1 and B31.9. Victaulic Style W07.
   b. Flexible Type Couplings: Housing key with lead-in chamfer, with key designed to fit into the wedge shaped AGS groove to allow for linear and angular movement. Victaulic Style W77.
   c. AGS couplings shall be installed to full metal-to-metal bolt pad contact at the required torque.
B. Grooved mechanical fittings shall be manufactured of ductile iron conforming to ASTM A536; forged carbon steel conforming to ASTM A234; or fabricated from carbon steel pipe conforming to ASTM A53.

1. Sizes 14 inches through 24 inches with wedge shaped ‘AGS’ grooved ends:
   a. Install AGS fittings with AGS couplings. Installing AGS products with standard grooved fittings and couplings will result in installation difficulties and could lead to joint separation and leakage.

2.4 VALVES

A. General

1. All valves used in 150 psi circulating systems shall be ANSI Class 150. All valves in 300 psi systems shall be Class 300 valves and shall be constructed of all ASTM B-61 composition. All gate, globe and angle valves shall be screw-over-bonnet design. Metal used in the stems of all bronze gate, globe and angle valves shall conform to ASTM B371 Alloy 694, ASTM B99 Alloy 651 or other corrosion resistant equivalents. Secure written approvals by Owner for the use of alternative materials.

2. The following manufacturers are acceptable: NIBCO, Keystone, Crane, Jamesbury, Dezurik, Daniels, Williams, Velan or Vogt.

3. All iron body valves shall have the pressure containing parts constructed of ASTM designated of 126 class B iron. Stem material shall meet ASTM B16 Alloy 360 or ASTM 371 Alloy 876 silicon bronze or its approved equivalent model by listed manufacturers.

4. All cast steel body valves shall have the pressure containing parts constructed of ASTM designation A-216-GR-WCB carbon steel. Stems shall meet ASTM designation A-186-F6 chromium stainless steel. Seat ring shall be hard faced carbon steel or 13\(^\text{th}\) chromium A-182-F6 stainless. Handwheels shall be A47 grade 35018 malleable iron or ductile iron ASTM A536.

5. All forged steel body valves shall have the pressure containing parts constructed of ASTM 105, Grade 2 forged carbon steel. Seat and wedges shall meet ASTM-A-182-F6 chromium stainless steel. Seat rings shall be hard faced. Valves shall conform to ANSI B16-34 pressure-temperature rating.

6. All gate valves, globe valves, angle valves and shutoff valves shall have malleable iron hand wheels, except iron body valves 2-½ inches and larger which may have either malleable iron or ASTM A-126 Class B, gray iron hand wheels.

7. Packing for all valves shall be free of asbestos fibers and selected for the pressure-temperature service of the valve. It is incumbent upon the manufacturer to select the best quality, standard packing for the intended valve service.

8. Provide stem extensions on all insulated valves.

9. Valve chain operators shall be of cast iron or malleable iron and designed to provide positive grip on wheel. Provide chain guide to prevent chain from slipping or jumping on wheel. Employ rustproof chain complete with closing link of sufficient length to operate at 6 feet-6 inches above floor level.

10. Provide valves suitable for connection to adjoining pipe as specified for pipe joints above. Use valves that are full size of pipe in which installed.

B. Gate Valves:

1. 150 Pound Class Valves:
   a. Threaded pipe 2-1/2 inches and smaller: NIBCO T-134 or approved equivalent model by listed manufacturers, bronze body, union bonnet, rising stem, solid wedge disc, threaded.
   b. Welded pipe 3 inches and larger: NIBCO F-617-0 or approved equivalent model by listed manufacturers, iron body, flanged, OS&Y (Outside Screw and Yoke), rising stem, solid wedge.

2. 300 Pound Class Valves:
   a. Threaded pipe 2 inches and smaller: NIBCO T-174-A or accepted substitute, bronze body, union bonnet, rising stem, solid wedge with integral seats threaded.
   b. Welded pipe 2-1/2 inches and larger: NIBCO F-667-0 or accepted substitute, iron body, OS&Y, rising stem, solid wedge, flanged.
3. Bolted bonnet with OS&Y (outside screw and yoke) and rising stem design, integral seats, with pressure temperature rating conforming to ANSI B16-34; NIBCO T-174-A for 2 inches and smaller.

C. Globe Valves:
1. 150 Pound Class Valves:
2. 300 Pound Class Valves:
   a. Threaded pipe 2 inches and smaller: NIBCO T276-AP, Class 300 screwed, inside screw rising stem, bronze body, union bonnet, stainless steel disc.
   b. Welded pipe 2-1/2 inches and larger. NIBCO F-768-B, Class 250 iron body, flanged, bolted bonnet, Brass Trim.

D. Soft Seated Butterfly Valves:
1. 200 Pound Soft Seated:
   a. NIBCO LD-2000 or approved equal.
   b. Ductile Iron body with Aluminum Bronze Disc, 400 series stainless steel stem.
   c. Temperature range from -50°F to +200°F.
   d. Valves 6 inches and smaller shall have lockable hand lever operators; 8 inches and larger shall have gear operators.
   e. All butterfly valves shall be suitable for bi-directional dead-end service without the need for a downstream flange.

E. High Performance Butterfly Valves:
1. 150 Pound Soft Seated Class Valves:
   a. NIBCO LCS-6822, carbon steel lug body valves. ANSI rated Class 150.
   b. Valves to provide tight shutoff up to 285 psi.
   c. Valves 6 inches and smaller shall have lockable hand lever operators; 8 inches and larger shall have gear operators.
   d. Provide 316 or UNS-S31803 stainless shaft, cast stainless steel disc, and soft seat.
   e. Temperature range from -50°F to +200°F.
2. 300 Pound Class Valves: NIBCO LCS-7822 300 lb. ANSI class raised face, lug body, carbon steel body, stainless steel pin and shaft and disc, soft seat, and gear operators.

F. Check Valves:
1. 150 Pound Class Valves:
   a. Threaded pipe 2 inches and smaller. NIBCO T453-B, bronze body, Class 200, screwed connection, regrinding disc and seat with screw in cap.
   b. Welded pipe 2-1/2 inches and larger. NIBCO F910-B. Flanged style, spring-loaded type. Rate for 150 psig working pressure; Cast Iron body, Bronze plates and 316 Stainless Steel springs.

G. Plug Valves:
1. 150 Pound Class Valves:
   a. Threaded pipe 2 inches and smaller: Dezurik 128 S 1 RS 26, Keystone 542, 150-pound screwed, eccentric plug valve, carbon steel or semi steel body, Buna-N faced plug, lever operated, nonlubricated, short pattern plug valve.
   b. Welded pipe 2-1/2 inches and larger: Dezurik 128 F 1 RS 26, Homestead 583. 150-pound flanged eccentric carbon steel or semi steel, Hycar or Buna-N faced plug, manually operated, nonlubricated, short pattern plug.
2. 300 Pound Class Valves:
   a. Threaded pipe 2 inches and smaller: Tufline 066, Powerll 3058. 300 psi working pressure, cast carbon steel body and plug, threaded end valve, bolted bonnet, nonlubricated or lubricated with lubricant suitable for water -20 degrees F to 450 degrees F temperature, wrench operated.
   b. Flanged piping 2-½ inches, cast carbon steel body and plug conforming to ASTM A216, Gr. WCB. Gear operated, bolted gland. Flanged per ANSI B16.5. Pipe sizes 4 inches through 12 inches. Nonlubricated or lubricated with lubricant suitable for water -20 degrees F to 450 degrees F temperature, 100 percent port.

H. Ball Valves:
1. Threaded pipe 2 inches and smaller: NIBCO T 585-70-66-LL. For threaded pipe 2-1/2 inches to 3 inches: Crane 9303-S or approved equivalent model by listed manufacturers.
   a. Threaded full port two-piece bronze body (ASTM-B584 Alloy 844, ASTM B61, or ASTM B62 (No brass containing more than 15 percent Zinc will be acceptable).
   b. Stainless steel ball and stem, blowout proof stem with stem extension made of non-thermal conducting material and having an adjustable memory stop after insulation is installed.
   c. Ball valves shall be provided with SS lockable handles and locking devices.
2. Welded pipe 2-1/2 inches and larger: NIBCO F-515-CS-66FS or accepted substitute for 150 pound Class; NIBCO F-535-CS-66FS for 300 pound class, split steel body, full bore, blowout proof stem with, flanged connections.

PART 3 - EXECUTION

3.1 PREPARATION
   A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
   B. Remove scale and dirt on inside and outside before assembly.
   C. Prepare piping connections to equipment with flanges or unions.
   D. After completion, fill, clean, and treat systems.

3.2 PIPING STORAGE REQUIREMENT
   A. All ERW and seamless piping shall be clearly identified and stored on separate construction pipe racks to prevent the intermixing of piping.
   B. Shop fabricated piping spool and pup pieces of ERW and seamless pipe shall be clearly identified and separated in the lay down yard to prevent the intermixing of piping.

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 valve installations shall be in accordance with manufacturer’s published recommendations.
   C. Pipe Installation:
      1. All the various piping systems shall be made up straight and true and run in orderly manner, plumb and parallel to building structural. Install piping to conserve building space. Coordinate location with other trades and do not interfere with use of space for other work.
      2. Piping shall follow as closely as possible the routes shown on Drawings which take into consideration conditions to be met at the Site.
      3. Should any unforeseen conditions arise, lines shall be changed or rerouted after proper approval has been obtained.
      4. All piping shall be installed with due regard to expansion and contraction and so as to prevent excessive strain and stress in the piping, in connections, or in equipment to which the lines are connected.
      5. Group piping whenever practical at common elevations.
      6. Slope piping and arrange system to drain at low points. Use eccentric reducers where applicable to maintain the bottom of pipe level.
      7. Branch tap connections are to be from the top to horizontal position of pipe run.
      8. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
      9. Provide and install Pete’s plugs adjacent to thermo wells for electronic temperature sensors, to electronic pressure sensors and install Pete’s plugs adjacent where shown or noted on piping drawings or drawing details.
     10. Provide clearance for installation of insulation, and access to valves and fittings.
     11. Prepare pipe, fittings, supports, and accessories for finish painting. Chilled water piping insulated with cellular glass does not require finish painting.
12. All piping shall be clean when it is installed. Before installation it shall be checked to assure it is the correct material to be used on the piping system, upended, swabbed if necessary, and all rust or dirt from storage or from lying on the ground shall be removed.

13. Where leaks occur, the pipe shall be repaired and the tests repeated. No leaks shall be corrected by peening. Defective piping and joints shall be removed and replaced.

14. Procedure of Assembling Screw Pipe Fittings: All screw joints shall be made with taper threads, properly cut. Joints shall be made tight with Teflon tape or Teflon-based compound appropriate to the medium, material and temperature range of the system. Compound shall be applied to the pipe threads only and not to fittings. When threads are cut on pipes, the ends shall be carefully reamed to remove any burrs. Before installing pipe that has been cut and threaded, the lengths of pipe shall be upended and hammered to remove all shavings and foreign material.

D. Valve Installation:

1. Locate all valves such that the removal of their bonnets is possible. All flanged valves shown in horizontal lines with the valve stem in a horizontal position shall be positioned so the valve stem is inclined one bolt hole above the horizontal position.

2. Screw pattern valves placed in horizontal lines shall be installed with their valve stems include at an angle of a minimum of 30 degrees above the horizontal position.

3. All valves must be true and straight at the time the system is tested and inspected for final acceptance.

4. Valves shall be installed as nearly as possible to the locations indicated in the Drawings. Any change in valve location must be so indicated on the Record As-Built Drawings.

5. All valves must be of threaded or flanged type. No solder connected or grooved fitting valves shall be used on this Project.

6. Equipment, valves, expansion joints, relief devices, strainers, etc., must be removed or isolated during the test if the pressure/force ratings of the devices are not as high as that specified for the test. Piping shall be drained and protected any time ambient temperature is below freezing.

7. Where leaks occur, the pipe shall be repaired and the tests repeated. No leaks shall be corrected by peening. Defective piping and joints shall be removed and replaced.

8. All threaded valves installed in copper piping shall be provided with copper or bronze male adapters on each side of valves. Sweat solder adapters to pipe before installing valves.

9. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with architectural drawings.

10. Install valves with stems upright or horizontal, not inverted.

11. All manually operated shutoff valves located 8 feet (Bottom of pipe) or higher above finished floor or stationary platform in mechanical rooms, accessible pipe chases or as noted on Project Drawings shall be chain wheel operated. Chains shall be installed and secured to allow clear passage at walk through areas.

3.4 TESTING

A. All welds are subject to inspection, visual and/or x-ray, for compliance with Specifications. The Owner will, at the Owner’s option, provide employees or employ a testing laboratory for the purposes of performing said inspections and/or x-ray testing. Initial visual and x-ray inspections will be provided by the Owner. The Contractor shall be responsible for all labor, material and travel expenses involved in the re-inspection and retesting of any welds found to be unacceptable. In addition, the Contractor shall be responsible for the costs involved in any and all additional testing required or recommended by ASME/ANSI Standards B31.9 due to the discovery of poor, unacceptable or rejected welds.

B. Welds lacking penetration, containing excessive porosity or cracks, or are found to be unacceptable for any reason, must be removed and replaced with an original quality weld as specified herein. All qualifying tests, welding and stress relieving procedures shall, moreover, be in accord with Standard Qualification for Welding Procedures, Welders and Welding Operators, Appendix A, Section 6 of the Code, current edition.

C. System Pressure Tests:
<table>
<thead>
<tr>
<th>Line</th>
<th>Testing Medium</th>
<th>Testing Pressure (psig)</th>
<th>Time (hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chilled Water and Condenser Water</td>
<td>Water</td>
<td>1-½ times working pressure, minimum 125</td>
<td>24</td>
</tr>
<tr>
<td>Heating Water and Generator Cooling Water</td>
<td>Water</td>
<td>1-½ times working pressure, minimum 125</td>
<td>24</td>
</tr>
</tbody>
</table>

1. Refer to the Drawings for system design pressure.

3.5 TRAINING
A. Victaulic Company shall provide on-site training for Contractor’s field personnel in the use of grooving tools, application of groove, and installation of grooved end couplings. The manufactures representative shall periodically visit the jobsite and provide the contractor information concerning the best recommended practices in grooved product installation. A distributor’s sales representative is not considered qualified to conduct the training or jobsite visit(s).

3.6 APPLICATION
A. Install valves and unions at equipment connections. Install unions on equipment side of valves. Provide dielectric isolation only where non-ferrous components connect to ferrous components.
B. Install brass male adapters each side of valves in copper piped system. Sweat solder adapters to pipe.
C. Install ball valves in piping 3 inches and smaller and butterfly valves in piping 4 inches and larger for shut-off and to isolate equipment, parts of systems, or vertical risers.
D. Install ball valves in piping 2 inches and smaller and butterfly valves in piping 2-1/2 inches and larger for throttling, bypass or manual flow control services. Under this application, throttling valves are not to be used for shutoff, and additional valves shall be installed for isolation.
E. Use plug valves for throttling service where indicated on Drawings.
F. Provide gate or ball drain valves at main shutoff valves, low points of piping, bases of vertical risers and at equipment. Pipe to nearest drain.

3.7 FLUSHING AND CLEANING OF PIPING SYSTEMS
A. Clean piping systems thoroughly. Purge pipe of construction debris and contamination before placing the piping systems in service. Provide whatever temporary connections are required for cleaning, purging and circulating fluids through the piping system.
B. On completely new piping system installations, the contractor shall use temporary strainers and temporary pumps that can create fluid velocities up to 10 ft / sec if necessary to flush and clean the piping systems. Do not use Owner’s permanent strainers to trap debris during pipe flushing operations. Fit the temporary construction strainers with a line size blowoff valve.
C. When constructing minor piping modifications or additions verify with Owner if the Owner’s pumps and strainers can be used for flushing and chemical cleaning operations. When the flushing and cleaning operations are complete, the contractor shall insure the strainer baskets and screens installed in the piping systems permanent strainers replaced with clean elements. Keep temporary strainers in service until the equipment has been tested, then replace straining element with a new strainer and clean and deliver the old straining elements to Owner. Fit the Owners strainers with a line size blowoff valve.
D. Install bypass piping or hoses at the supply and return piping connections at heat exchangers, chillers, cooling towers, pumps and cooling coils, etc, to prevent debris from being caught or causing damage to equipment which will be connected to the piping system.
E. Circulate a chemical cleaner in chilled and heating water as well as condenser and generator cooling piping systems to remove mill scale, grease, oil and silt. Circulate Betz Entec 323 detergent with Betz Entec 234 antifoam compound. Circulate for 48 hours, flush system and replace with clean water. Dispose of chemical solution in accordance with local codes. The chilled and heating water system should then be treated with Betz Entec 338, nitride borate, 350 ppm as nitride with MBP inhibitor. When the chemical cleaning is complete, remove, clean and reinstall all permanent screens. Contractor shall notify Owner so that the reinstallation of clean strainer screens may be witnessed.

3.8 WELDING

A. Scope: This article applies to welded chilled and heating water piping fittings and other appurtenances.

1. Piping and fittings shall be welded and fabricated in accordance with the latest edition of ASME/ANSI the latest editions of Standards B31.9 for all systems. Machine beveling in shop is preferred. Field beveling may be done by flame cutting to recognized standards.

2. Ensure complete penetration of deposited metal with base metal.
   a. Contractor shall provide filler metal suitable for use with base metal. Contractor shall keep inside of fittings free from globules of weld metal.
   b. All welded pipe joints shall be made by the fusion welding process, employing a metallic arc or gas welding process.
   c. All pipe shall have the ends beveled 37-½ degrees and all joints shall be aligned true before welding.
   d. Except as specified otherwise, all changes in direction, intersection of lines, reduction in pipe size and the like shall be made with factory-fabricated welding fittings. Mitering of pipe to form elbows, notching of straight runs to form tees, or any similar construction is not permitted.

3. Align piping and equipment so that no part is offset more than 1/16-inch. Set all fittings and joints square and true, and preserve alignment during welding operation. Use of alignment rods inside pipe is prohibited.

4. No weld shall project into the pipe so as to restrict it. 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.

5. Remove all split, bent, flattened or otherwise damaged piping from the Project Site.

6. Remove dirt, scale and other foreign matter from the inside of piping, by swabbing or flushing, prior to the connection of other piping sections, fittings, valves or equipment.

7. Schedule 40 pipe shall not be welded with less than three (3) passes including one stringer/root, one filler and one lacer. Schedule 80 pipe shall be welded with not less than four (4) passes including one stringer/root, two filler and one lacer. In all cases, however, the weld must be filled before the cap weld is added.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01 & Division 20 Specification Sections, apply to this Section and to applicable Division 23 sections.

1.2 SUMMARY
   A. End Suction Pumps.
   B. In-Line Pumps.

1.3 SUBMITTALS
   A. Submit manufacturer's product data showing dimensions and materials of construction.
   B. Submit factory certified performance curves for the actual pump that will be supplied showing impeller diameter, efficiency, horsepower, net positive suction head and with the operating point clearly marked.

1.4 QUALITY ASSURANCE
   A. Pumps shall be constructed in accordance with Hydraulic Institute Standards.
   B. Each pump furnished under these specifications shall be capacity tested at the factory for design flow after final assembly.
   C. For each pump with a motor horsepower greater than five, provide a certified shop performance test curve indicating capacity, head, performance and efficiency at flow rates from shut off to 125 percent of design flow. When the pumps are shipped from the factory, the manufacturer shall transmit three (3) copies of a certified letter stating the pumps have been dynamically balanced and tested. No pump shall be installed until its test data has been reviewed.
   D. Provide one set of mechanical seals with each pump.

1.5 PAINTING
   A. Pump and pump base shall be factory coated with minimum two (2) coats of factory standard paint. Color is to be factory standard.

1.6 WARRANTY
   A. Provide a warranty on all materials and labor for a period of one (1) year starting from the date of final acceptance.
PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS
A. ITT Bell & Gossett.
B. TACO.
C. Armstrong Pumps.

2.2 END SUCTION PUMPS
A. Casing:
   1. The casing shall be ASTM A48 cast iron of the end suction design with tangential discharge outlet. The casing shall have tapped and plugged holes for priming and draining. The casing bore shall be large enough to allow removal of the impeller without disturbing the casing or suction and discharge piping.
   2. The pump case shall be fitted with a case wear ring to minimize abrasive and corrosive wear to the casing. The case wear ring shall be of the radial type, press fitted into the casing.
   3. For suction piping diameters of 2-1/2 inches or greater and discharge piping diameters of two (2) inches or greater, flange connections shall be ANSI 125# rated.
   4. Provide machine enamel finish.

B. The impeller shall be ASTM B584 bronze, enclosed type, vacuum cast in one piece, keyed to the shaft and fastened with a washer, gasket and cap screw. It shall be finished smooth and cleaned of all burrs, trimmings and irregularities. The impeller shall be hydrostatically and dynamically balanced, and be of a diameter not greater than 85% of the cut-water diameter.

C. Shaft:
   1. The shaft shall be AISI C1045 steel direct-coupled to the power frame shaft. The shaft shall be machined to provide an impeller keyway, and drilled and tapped to accept the impeller fastener. The outboard shaft extension shall be machined with a keyway to accept a coupling to the driving unit.
   2. Shaft sleeves shall be ASTM B62 bronze and shall be sealed to the impeller hub by an O-ring, and shall be positively driven by a pin to the keyway. The use of adhesive compounds to fasten the sleeve to the shaft shall not be accepted.

D. Stuffing Box:
   1. The stuffing box shall be integrally cast with a mounting bracket, and shall provide an adequate area for internal re-circulation of the pumped fluid around the sealing medium.
   2. Each stuffing box shall be furnished with John Crane Type 21 mechanical seals. All metal parts of the seal shall be stainless steel with “Buna-N” elastomers, Ni-Resist seals and carbon washers.
   3. Provide one (1) set of replacement mechanical seals for each size of pump. After the pumps are in operation for ninety days, the Contractor shall check the seals and replace any that are defective. If the replacement seals are not used during the ninety-day operational period, they shall be delivered to the Owner.
E. The power frame shall house regreaseable ball bearings selected for a three year minimum life at maximum load. Lubrication fittings shall be provided in convenient location.

F. The pump unit shall be supported from beneath the mounting bracket and the power frame by mounting feet.

G. Pump and motor shall be mounted on a common drip lip type cast iron or fabricated structural steel base. The base shall have provisions for grouting, anchor bolts, and collection of all seal leakage. The base shall have machined surfaces for the motor and pump mounting surfaces. Motor mounting shall permit horizontal adjustment. A threaded outlet of \( \frac{3}{4} \) inch minimum size shall be provided at the pump end for field piping of drainage to drain. The base shall be of sufficient strength to prevent vibration, warping, or misalignment of the pump and motor when installed without grouting. Structural steel bases shall be fabricated with continuous welds. Spot welding is not acceptable. Bases shall be hot dipped galvanized after fabrication. The base shall be rigidly bolted to the vibration isolation base. After final alignment, pumps 25 horsepower and over shall have the pump and motor doweled to the base. In addition, the minimum requirements of the fabricated structural steel base shall be as follows:

1. For pumps driven by motors 20 horsepower and smaller, the steel base shall be fabricated of formed steel shapes adequately stiffened as required to prevent "oil-canning."

2. For pumps driven by motors 25 horsepower and larger, the steel base shall be fabricated of structural shapes and formed steel section. The main structural member and formed steel sections shall have a depth of at least \( \frac{1}{12} \)th the overall length of the base but not less than 4 inches. The base shall be filled with concrete or grout after installation on the isolation base.

H. A Woods “Sure-Flex” flexible coupling shall be provided to connect the pump shaft to the motor shaft. The coupling shall be all metal type with a flexible rubber insert. The entire rotating coupling element shall be enclosed by a coupling guard. Coupling alignment and pump vibration shall be field-checked. See the Section entitled, "Testing, Balancing, and Adjusting" for alignment and vibration tests. Provide factory manufactured coupling guards, which comply with OSHA requirements.

I. Motor:

1. Motor shall be in accordance with applicable Section of these specifications.

2. Each motor shall have a sufficient horsepower rating to operate the pump at any point on the pump’s head-capacity curve without overloading the nameplate horsepower rating of the motor, regardless of service factor.

3. The motor shall have a service factor of 1.15. The service factor is reserved for variations in voltage and frequency.

2.3 CLOSE-COUPLLED, IN-LINE CENTRIFUGAL PUMPS

A. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, close-coupled, inline pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally or vertically.

B. Pump Construction:

1. Casing: Radially split, cast iron, with threaded gage tapings at inlet and outlet, replaceable bronze wear rings, and threaded companion-flange connections.
2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. For constant-speed pumps, trim impeller to match specified performance.


4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and EPT bellows and gasket. Include water slinger on shaft between motor and seal.

5. Seal: Packing seal consisting of stuffing box with a minimum of four rings of graphite impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland.


C. Motor: Single speed and rigidly mounted to pump casing.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors.
   a. Enclosure: Open, dripproof.
   b. Enclosure Materials: Cast iron.
   c. Motor Bearings: Permanently lubricated ball bearings.
   d. Unusual Service Conditions:
      1) Ambient Temperature: 105 deg F.
      2) Altitude: 200 feet above sea level.
      3) High humidity.
   e. Efficiency: Premium efficient.
   f. NEMA Design: JM.
   g. Capacities and Characteristics:
      1) Refer to Schedule on Plans.

2.4 PUMP SPECIALTY FITTINGS

A. Suction Diffuser: Angle pattern, 175-psig pressure rating, cast-iron or ductile-iron body and end cap, pump-inlet fitting; with bronze startup and bronze or stainless-steel permanent strainers; bronze or stainless-steel straightening vanes; drain plug; and factory-fabricated support.

PART 3 - EXECUTION

3.1 INSPECTION

A. Field verify all dimensions. If any deviations from the Drawings are required by the Contractor, details of such deviations shall be submitted in writing for approval. Deviations shall not be made until written approval has been made.

B. Alignment of the pump, motor and coupling shall be checked, and corrected if necessary, after installation and prior to energizing the pump motor.
3.2 INSTALLATION

A. Install according to manufacturer's printed recommendations and pipe as shown on drawings. Grout pump base. See Section 23 05 00 for requirements on noise, field alignment and balancing. Requirements in other sections of Division 23 and Division 26 apply to pumps and motors in this Section.

B. Provide adequate service and maintenance access around pump and motor. Provide no less than a minimum of 2 ft.-6 in., not including piping and piping appurtenances.

C. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For close coupled or base mounted pumps, provide supports under elbows on pump suction and discharge line sizes 4 inches and over.

D. Factory technician shall check, align and provide written certification of pump alignment to Owner prior to operation. Lubricate pumps prior to start-up.

E. Vibration Testing: Vibration velocity readings shall be taken at all bearing locations of all pumps. Pumps driven by variable speed drives shall be tested throughout their range of speeds. Vibration shall not exceed 0.15 inch/second (peak). Record and deliver copies of the test report to the Owner and include report in the O&M Manual.

F. Provide a spare manufacturer's stainless steel nameplate with each pump and install on pump inertia base.

G. Pump manufacturer's representative shall:
   1. Engage a factory-authorized service representative to perform startup service. Complete installation and startup checks according to manufacturer's written instructions.
   2. Furnish wiring diagram for field wiring.
   3. Verify pump alignment.
   4. Inspect completed pump installation.
   5. Certify in writing that installation and operation of the pump are complete and correct.

H. Upon completion of the installation, pump shall be aligned with dial indicators, and shall be certified by written report of tolerances, under the supervision of the Mechanical Engineer.

I. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
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. Provide complete chemical water treatment systems for the following systems:
   1. Closed loop chilled water.
   2. Closed loop heating hot water.
   3. Open loop cooling tower water.
B. Provide chemicals as required to control scale, corrosion, biological fouling and biological foaming.
C. Coordinate tap and sensor locations with Drawings and the water treatment manufacturer's requirements.
D. Provide supervision of the water treatment program for a period of one year consisting of on-the-spot analysis of all systems treated and a submittal of a written report to Owner and Engineer stating current conditions and recommendations for maintaining optimal controls. This service shall be performed monthly.

1.3 REFERENCE STANDARDS
A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within all references.

1.4 QUALITY ASSURANCE
A. The water treatment chemical and service supplier shall be a recognized specialist, active in the field of industrial water treatment for the last ten (10) years, whose major business is in the field of water treatment. Supplier shall have regional water analysis laboratories, development facilities and service department, plus full-time service personnel located within the training area of the Project Site.
B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 SUBMITTALS
A. Product Data:
   1. Include rated capacities; water-pressure drops; shipping, installed, and operating weights; and furnished products listed below:
      a. Pumps.
      b. Chemical solution tanks.
      c. Agitators.
      d. Control equipment and devices.
      e. Test equipment.
      f. Chemicals.
g. Filters.
h. Chemical feeders.
i. Bypass Chemical pot feeders.

2. Shop Drawings: Detail equipment assemblies indicating dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   a. Wiring Diagrams: Detail power and control wiring and differentiate between manufacturer-installed and field-installed wiring.

3. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project Site.

4. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

B. Operation and Maintenance Data:
   1. For pumps, agitators, filters, system controls, and accessories to include in Operating and Maintenance Manuals.
   2. Furnish manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

B. Chemical Feed System Description:
   1. Closed-Loop System: One bypass feeder on each system with isolating and drain valves with inlet piping connecting to discharge of circulating pumps, and outlet side of feeder connected to suction side of pump unless otherwise indicated.
   2. Introduce chemical treatment through bypass feeder when required or indicated by test.
   3. Open-Loop System, Condenser Water Piping: Pump sequestering agent and corrosion inhibitor from solution tank into condenser water supply to tower. Use agitator as required.
      a. Intermittently feed biocide to condenser water to achieve a toxic level of the chemical to kill the organism present.
      b. Activate chemical solution pump from water meter which is separate from the make-up water line to the cooling tower when condenser water pumps are running.
      c. Activate chemical solution pump from the make-up contacting head water meter.
      d. Automatically feed chemical with electronic solid-state controllers.
      e. Deactivate solution pump and signal alarm by a liquid-level switch in each solution tank on low chemicals.

C. Performance Requirements:
   1. Maintain water quality for HVAC systems that controls corrosion and build-up of scale and biological growth for maximum efficiency of installed equipment without posing a hazard to operating personnel or the environment.
   2. Base chemical treatment performance requirements on the quality of water at the Project Site HVAC system equipment material and operating personnel capabilities, and the capability of personnel and guidelines of authorities having jurisdiction at the Project Site.
      a. Closed System: Maintain system essentially free of scale, corrosion, and fouling to sustain the following water characteristics:
         1) Conductivity: 1200 to 2500 umhos. (nitrite raises system conductivity)
         2) Acceptable pH: Not less than 7.5 or greater than 8.5 10.0 (except for piping flush and clean step where the pH level is in the alkaline range of 9.5 to 10.5).
         3) Hardness: < 5 ppm. (when closed loops have soft water make-up water)
      b. Condenser Water, Medium-to-Large Cooling Tower System: Maintain system essentially free of scale and total suspended solids to sustain the following water characteristics:
         1) Conductivity: 1500-1600 mmhos (1500 – 1650 umhos)
2) Acceptable pH: Not less than 8 or greater than 9.5.

c. Boiler:
   1) Boiler Conductivity: 3000-4000 mmhos.
   2) Hardness < 5 ppm.
   3) Acceptable pH: Not less than 9 or greater than 12.5. (9 or greater than 12.5)
   4) Softener: yes.

2.2 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:
   a. Anerson Chemical Company
   b. Cascade Water Services, Inc

2.3 CHEMICAL FEEDING EQUIPMENT

A. Bypass Chemical Pot Feeders: Steel or stainless steel, for introducing chemicals into the
   system; with funnel shutoff valve on top, air-release valve on top, drain valve on bottom, and
   recirculating shutoff valves on sides.

B. Positive-Displacement Diaphragm Pump: Simplex, self-priming, rated for intended chemical
   with 25 percent safety factor for design pressure and temperature.
   1. Pump shall be capable of providing an adjustable flow rate.
   2. Pump shall be of thermoplastic construction.
   3. Pump motor shall be fully enclosed, continuous-duty, 120-V, 60-Hz, single-phase
      motor.
   4. Pump shall have a built-in relief valve.

C. Positive-Displacement Piston Pump: Metal and thermoplastic construction.
   1. Pump motor shall be fully enclosed, continuous-duty, 120-V, 60-Hz, single-phase
      motor.
   2. Pump shall have a built-in relief valve.

D. Chemical Solution Tanks: Chemical-resistant reservoirs fabricated from high-density
   opaque polyethylene with graduated markings.
   1. Polypropylene Molded cover with recess for mounting pump, agitator, and liquid-level
      switch.
   2. Capacity equal to 50 gallons unless specified otherwise on the Drawings.

E. Agitator: Direct drive, 1750 rpm, mounted on tank with angle adjustment.
   1. Agitator motor shall be fully enclosed, continuous-duty, 120-V, 60-Hz, single-phase
      motor.
   2. Stainless-steel clamp and motor mount, with stainless-steel shaft and propeller.

F. Liquid-Level Switch: Polypropylene housing, Liquid-Level Switch: Polypropylene housing,
   integrally mounted PVC air trap, receptacles for connection to metering pump, and low-level
   alarm.

G. Packaged Conductivity Controller: Solid-state circuitry, 5 percent accuracy, linear dial
   adjustment, built-in calibration switch, on-off switch and light, control-function light, output to
   control circuit, and recorder.

H. Cold-Water Meter: Positive-displacement type with sealed, tamperproof magnetic drive;
   impulse contact register; single-pole, double-throw, dry-contact switch.
   1. Turbine type with bronze or cast-iron body rated for 125 psig.
   2. Magnetic-drive or mechanical-impulse contactor matched to signal receiver.
   3. At least six-digit totalizer.
   4. Contact switches shall be rated at 5 amps, 120-Vac.

I. Solenoid Valves: Forged-brass body, globe pattern, and general-purpose solenoid
   enclosure with 120-V, continuous-duty coil.

J. Electronic Timers: 150-second and 5-minute ranges, with infinite adjustment over full range,
   and mounted in cabinet with hand-off-auto switches and status lights.

K. Chemical Tubing: Schedule 40 PVC with solvent-cement joints; or polypropylene tubing with
   heat fusion.

L. Plastic Ball Valves: Rigid PVC or CPVC body, integral union ends, and
   polytetrafluoroethylene seats and seals.
M. Plastic-Body Strainer: Rigid PVC or CPVC with cleanable stainless-steel strainer element.

N. Condenser Water-Treatment Control Panel: Incorporate solid-state integrated circuits and digital LED displays, in NEMA 250, Type 12 enclosure with gasketed and lockable door.

1. Control dissolved solids, based on conductivity, and shall include the following:
   a. Digital readout display.
   b. Temperature-compensated sensor probe adaptable to sample stream manifold.
   c. High, low, and normal conductance indicator lights. Programmable set points and alarms.
   d. High or low conductance alarm light, trip points field adjustable; with silence switch.
   e. Hand-off-auto switch for solenoid bleed-off valve.
   f. Bleed-off light to indicate valve operation.
   g. Internal adjustable hysteresis or dead band.
   h. Network and phone line capable controller for remote monitoring/alarming

2. Control inhibitor feeding, based on make-up volume, and shall include the following:
   a. Solid-state reset counter (accumulator), with selections from 1 to 15.
   b. Solid-state timer, adjustable from 15 to 300 seconds.
   c. Test switch.
   d. Hand-off-auto switch for chemical pump.
   e. Illuminated legend to indicate feed when pump is activated.
   f. Solid-state lockout timer, adjustable from 15 to 180 minutes, with indicator light. Lockout timer to deactivate the pump and activate alarm circuits.
   g. Electromechanical-type, panel-mounted make-up totalizer to measure amount of make-up water.

3. Control biocide with an adjustable time programmer and shall include the following:
   a. 24-hour timer with 14-day skip feature to permit activation any hour of the day.
   b. Precision, solid-state, bleed-off lockout (zero to nine hours) and biocide module (zero to two and one-half hours). Pre-bleed and bleed lockout.
   c. Solid-state alternator to enable the use of two different formulations.
   d. 24-hour digital display of time of day.
   e. 14-day LED display of day of week.
   f. Fast and slow internal clock set controls.
   g. Battery backup so clock is not disturbed by power outages.
   h. Quartz timekeeping accuracy.
   i. Hand-off-auto switches for biocide pumps.
   j. Biocide A and Biocide B illuminated legends to indicate pump is running.

2.4 CHEMICAL TREATMENT TEST EQUIPMENT

A. Test Kit: Manufacturer recommended equipment and chemicals, in a carrying case, for testing pH, total dissolved solids, dissolved oxygen, biocount, chloride, and total alkalinity and for calcium hardness field tests.

B. Corrosion Test Coupon Assembly: Constructed of corrosion material, complete with piping, valves, and mild steel and copper coupons. Locate copper coupon downstream from mild steel coupon in the test coupon assembly.
   1. Two-station rack for closed-loop systems.
   2. Four-station rack for open condenser water systems.

2.5 CHEMICALS

A. Furnish chemicals recommended by water-treatment system manufacturer that are compatible with piping system components and connected equipment.

B. System Cleaner: Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products.

C. Biocide: Chlorine release agents or microbiocides.

D. Closed-Loop, Water Piping Chemicals: Sequestering agent to reduce deposits and adjust pH, corrosion inhibitors, and conductivity enhancers.
2.6 CONDENSER WATER FILTRATION UNIT
A. Description: Filtration unit, including sand filter, filter pump, strainer, and controls; factory assembled, piped, and wired; mounted to steel skid.
B. Sand Filter: Glass-fiber-reinforced polyester tank, internal distribution piping, differential gauge panel, manual and automatic pressure relief valves, backwash valve, and backwash sight tube; graded silica sand installed according to manufacturer's written instructions.
C. Pump: All-bronze, centrifugal filter pump with totally enclosed, fan-cooled motor; strainer mounted on pump suction; and manually reset, motor-overload switch with pilot light.
D. Backwash Control: Automatic, with time clocks and differential pressure switches; mounted in NEMA 250, Type 4 control panel; factory wired for single, external electrical connection.

2.7 HOT-WATER/CHILLED-WATER FILTRATION UNIT
A. Filtration Unit: Stainless-steel housing and polypropylene filter with polypropylene core.
B. Replaceable Filter Media: Compatible with antifreeze and water-treatment chemicals.
C. Filter Media for Sediment Removal Service: Rated at 98 percent efficiency for 20-micrometer particulate.

PART 3 - EXECUTION

3.1 PREPARATION
A. Water Analysis
1. Perform an analysis of supply water to determine the type and quantities of chemical treatment needed to maintain the water quality as specified in "Performance Requirements" Article.

3.2 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 manufacturer’s published recommendations.
C. Install treatment equipment level and plumb.
D. Add cleaning chemicals as recommended by manufacturer.
E. Connections:
1. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
2. Install piping adjacent to equipment to allow service and maintenance.
3. Confirm applicable electrical requirements in Division 26 Sections for connecting electrical equipment.
4. Ground equipment.
5. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 TESTING
A. Engage a factory-authorized service representative to perform Start-up service.
1. Inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
2. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.
3. Place HVAC water-treatment system into operation and calibrate controls during HVAC system Start-up procedures.
B. Test chemical feed piping as follows:
1. Do not enclose, cover, or put piping into operation until it is tested and satisfactory test results are achieved.
2. Test for leaks and defects. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
3. Leave uncovered and un concealed new, altered, extended, and replaced water piping until it has been tested and approved. Expose Work that has been covered or concealed before it has been tested and approved.
4. Cap and subject piping to static water pressure of [50 psig (345 kPa)] above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow test pressure to stand for four (4) hours. Leaks and loss in test pressure constitute defects.
5. Repair leaks and defects with new materials and retest piping until satisfactory results are obtained.
6. Prepare test reports, including required corrective action.

C. Adjusting:
1. Sample boiler water at one-week intervals after boiler Start-up for a period of five (5) weeks, and prepare certified test report for each required water performance characteristic. Where applicable, comply with ASTM D 3370 and the following standards:
   e. Water Hardness: ASTM D 1126.
2. Occupancy Adjustments: Within 12 months of Substantial Completion, perform two (2) separate water analyses to prove that automatic chemical feed systems are maintaining water quality within performance requirements specified in this Section. Perform analyses at least 60 calendar days apart. Submit written reports of water analysis.

3.4 TRAINING

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC water-treatment systems and equipment.
B. Train Owner’s maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
   1. Schedule minimum four (4) hours of training with Owner.
   2. Provide at least seven calendar days advance notice.
C. Review manufacturer's safety data sheets for handling of chemicals.
D. Review data in maintenance manuals, especially data on recommended parts inventory and supply sources and on availability of parts and service.
E. Review data in maintenance manuals, especially data on recommended parts inventory and supply sources and on availability of parts and service.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 & Division 20 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. Perform Work required to provide and install ductwork, flexible duct, hangers, supports, sleeves, flashings, vent flues, and all necessary accessories as indicated in the Contract Documents. Provide any supplementary items necessary for proper installation.
B. Conform with Sustainability Requirement, criteria associated w/ AEGB IEQ7 Low Emitting Materials - sealants + adhesives.

1.3 REFERENCE STANDARDS
A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:
   1. ASHRAE - Handbook of Fundamentals; Duct Design.
   2. ASHRAE - Handbook of HVAC Systems and Equipment; Duct Construction.
   3. ASTM A 90 - Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.
   5. ASTM A 525 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
   6. ASTM A 527 - Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Lock Forming Quality.
   8. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems.
   10. SMACNA – Rectangular Industrial Duct Construction Standards.
   11. SMACNA – Round Industrial Duct Construction Standards.
   13. UL 181 - Factory-Made Air Ducts and Connectors.
   15. Assembly and Installation of Spiral Ducts and Fittings, UMC.
   16. Engineering Report No. 132 (Spacing of Duct Hangers), UMC.
   17. AWSD1.1 American Welding Society Structural Welding Code.

1.4 DEFINITIONS
A. Low Pressure
   1. 2 inch W.G. Pressure Class: Ductwork systems up to 2 inch w.g. positive or negative static pressure with velocities less than or equal to 1500 fpm.
B. MEDIUM PRESSURE
1. 3 inch W.G. Pressure Class: Ductwork systems over 2 inch w.g. and up to 3 inch w.g. positive or negative static pressure with velocities less than or equal to 2500 fpm.
2. 4 inch W.G. Pressure Class: Ductwork systems over 3 inch w.g. and up to 4 inch w.g. positive or negative static pressure with velocities less than or equal to 2500 fpm.
3. 6 inch W.G. Pressure Class: Ductwork systems over 4 inch w.g. and up to 6 inch w.g. positive or negative static pressure with velocities less than or equal to 2500 fpm.

1.5 SUBMITTALS

A. Product Data:
   1. Provide the following information for each sheet metal system furnished on the Project:
      a. System name and type.
      b. Duct system design pressure.
      c. Duct material.
      d. Duct gage.
      e. Transverse joint methods.
      f. Longitudinal seam type.
      g. Sealant type.
      h. SMACNA rectangular reinforcement type.
      i. SMACNA intermediate reinforcement type.
      j. SMACNA transverse reinforcement type.

B. AEGB Submittal:
   1. Product data complying with Basic Requirements 7 - Low Emitting Materials – Interior Paints and Coatings
      a. Insulation containing no-added formaldehyde or ultra-low-emitting formaldehyde per CARB ATCM,
      b. VOC content for adhesives/sealants

C. Shop Drawings:
   1. Draw ductwork Shop Drawings on minimum 1/4 inch equal to one foot scale building floor plans and shall indicate duct sizes, material, insulation type, locations of transverse joints, fittings, ductwork bottom elevation, offsets, ductwork specialties, fire and fire/smoke dampers, and other information required for coordination with other trades. Clearly designate fire and fire/smoke partitions on the Shop Drawings. Detail Drawings for mechanical rooms and air handling unit locations shall be submitted at a minimum scale of 1/4 inch equal to one foot.
   2. Coordinate with all other trades and building construction prior to submitting Shop Drawings for review. Indicate location of all supply, return, exhaust, and light fixtures from approved reflected ceiling plans on Shop Drawings.
   3. Ductwork construction details and materials used for duct sealant, flexible connections, etc. shall be submitted and approved prior to the fabrication of any ductwork.

D. Record Documents:
   1. Submit record drawings on all items of ductwork, plenums, and casings including construction details and accessories and changes required during construction to accommodate coordination issues specified herein in accordance with Division 01.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver products to the Project Site and store and protect products under provisions of Division 01 and Division 20.
B. Protect materials from rust both before and after installation.

1.7 WARRANTY

A. All ductwork shown on the Drawings, specified or required for the air conditioning and ventilating systems shall be constructed and erected in a first class workmanlike manner.
B. The Work shall be guaranteed for a period of one (1) year from the Project Substantial Completion date against noise, chatter, whistling, vibration, and free from pulsation under all conditions of operation. After the system is in operation, should these defects occur, they shall be corrected as directed by the Owner at Contractor's expense.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

2.2 APPLICATION

A. Ductwork systems shall be constructed in accordance with the following Materials as a minimum standard. Refer to Drawings for any deviation from this Table.

<table>
<thead>
<tr>
<th>AIR SYSTEM</th>
<th>MATERIAL</th>
<th>MINIMUM PRESSURE CLASSIFICATION (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply and Return Systems:</td>
<td></td>
<td></td>
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<tr>
<td>Untreated Outside Air Intake (Louver) to AHU Plenum</td>
<td>Galvanized Steel</td>
<td>Low Pressure</td>
</tr>
<tr>
<td>Treated Outside Air to AHU</td>
<td>Galvanized Steel</td>
<td>Medium Pressure</td>
</tr>
<tr>
<td>Single Zone Supply and Return</td>
<td>Galvanized Steel</td>
<td>Low Pressure</td>
</tr>
<tr>
<td>Single Zone AHU Supply</td>
<td>Galvanized Steel</td>
<td>Medium Pressure</td>
</tr>
<tr>
<td>Mixed Air (AHU Plenum)</td>
<td>Galvanized Steel</td>
<td>Medium Pressure</td>
</tr>
<tr>
<td>AHU Discharge/Vertical Supply Riser</td>
<td>Galvanized Steel</td>
<td>Medium Pressure</td>
</tr>
<tr>
<td>Exterior Oval Ductwork</td>
<td>Galvanized Steel</td>
<td>Medium Pressure</td>
</tr>
<tr>
<td>Terminal Unit Connection</td>
<td>Metal Flexible Duct</td>
<td>As Specified</td>
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<tr>
<td>Terminal Units to Supply Air Device</td>
<td>Galvanized Steel (2)</td>
<td>Low Pressure</td>
</tr>
<tr>
<td>Return Air Device to Return Distribution</td>
<td>Galvanized Steel (2)</td>
<td>Low Pressure</td>
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<tr>
<td>Return Air Distribution</td>
<td>Galvanized Steel</td>
<td>Medium Pressure</td>
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<tr>
<td>Return Air Distribution/Vertical Riser</td>
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<td>Exhaust Air Device to Exhaust Distribution</td>
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<td>Exhaust Air Distribution</td>
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<td>Medium Pressure</td>
</tr>
<tr>
<td>General Exhaust Vertical Riser to Fan</td>
<td>Galvanized Steel</td>
<td>Medium Pressure</td>
</tr>
</tbody>
</table>

B. Notes to Table:
1. Positive pressure unless noted otherwise in Table.
2. Air device connections may be made with insulated flexible duct as specified herein.
3. Verify minimum pressure classification per NFPA 96 requirements.

2.3 DUCTWORK MATERIAL AND CONSTRUCTION

A. All ductwork indicated on the Drawings, specified or required for the air conditioning and ventilating systems shall be of materials as hereinafter specified unless indicated otherwise on Drawings. All air distribution ductwork shall be fabricated, erected, supported, etc., in accordance with all applicable standards of SMACNA where such standards do not conflict with NFPA 90A and where class of construction equals or exceeds that noted herein.

B. Ductwork shall be constructed of G-90 coated galvanized steel of ASTM A653 and A924 Standards.

C. Minimum gage of round, oval or rectangular ductwork shall be 26 gage per SMACNA Standards.

D. All duct sizes shown on the Drawings are clear inside dimensions. Allowance shall be made for internal lining, where specified, to provide the required free area.
E. All holes in ducts for damper rods and other necessary devices shall be either drilled or machine punched (not pin punched), and shall not be any larger than necessary. All duct openings shall be provided with sheet metal caps if the openings are to be left unconnected for any length of time.

F. Except for specific duct applications specified herein, all sheet metal shall be constructed from prime galvanized steel sheets and/or coils up to 60 inches in width. Each sheet shall be stenciled with manufacturer’s name and gage.

G. Sheet metal must conform to SMACNA sheet metal tolerances as outlined in SMACNA’s “HVAC Duct Construction Standards.”

H. Where ducts are exposed to view (including equipment rooms) and where ducts pass through walls, floors or ceilings; furnish and install sheet metal collars around the duct.

I. Spin-in fittings shall be as specified under Section 23 33 00 – Ductwork Accessories.

J. Duct Sealing: Shall comply with AEGB IEQ7 Low Emitting Materials - sealants + adhesives. All ductwork, regardless of system pressure classification, shall be sealed in accordance with Seal Class A, as referenced in SMACNA Standards. All transverse joints, longitudinal seams, and duct wall penetrations shall be sealed.

1. All seams and joints in shop and field fabricated ductwork shall be sealed by applying one layer of sealant, then immediately spanning the joint with a single layer of 3 inches wide open weave fiberglass scrim tape. Sufficient additional sealant shall then be applied to completely embed the cloth.

2. Sealant shall be water based, latex UL 181B-M sealant with flame spread of 0 and smoke developed of 0. Sealants shall be similar to Hard Cast Iron Grip 601, Ductmate Pro Seal or Design Polymerics DP 1010.

3. Scrim tape shall be fiberglass open weave tape, 3 inches wide, with maximum 20/10 thread count, similar to Hardcast FS-150.

4. Sealer shall be rated by the manufacturer and shall be suitable for use at the system pressure classification of applicable ductwork.

5. Except as noted, oil or solvent-based sealants are specifically prohibited.

6. For exterior applications, “Uni-Weather” (United McGill Corporation) solvent-based sealant shall be used.

2.4 RECTANGULAR AND ROUND DUCTWORK

A. Metal gages listed in SMACNA HVAC Duct Construction Standards, Metal and Flexible Duct, are the minimum gages which shall be used. Select metal gage heavy enough to withstand the physical abuse of the installation. In no case shall ductwork be less than 26 gage per SMACNA Standards.

B. All longitudinal seams for rectangular duct shall be selected for the specified material and pressure classification. Seams shall be as referenced in SMACNA Standards.

C. Longitudinal seams in laboratory hood exhaust ducts shall be welded.

D. All transverse joints and intermediate reinforcement on rectangular duct shall be as shown in SMACNA Standards. Transverse joints shall be selected consistent with the specified pressure classification, material, and other provisions for proper assembly of ductwork.

E. Spiral round duct and fittings shall be as manufactured by United McGill Sheet Metal Company or approved equivalent. All fittings shall be factory fabricated, machine formed and welded from galvanized sheet metal.

F. Joints in spiral duct and fittings shall be assembled, suspended, sealed, and taped per manufacturer’s published assembly and installation instructions.

G. Contractor may use DUCTMATE or Ward Industries coupling system, as an option, on rectangular ductwork. The DUCTMATE or Ward Industries system shall be installed in strict accordance with manufacturer’s recommendations.

2.5 FLAT OVAL DUCTWORK AND FITTINGS

A. Oval ducts shall be spiral flat oval or welded flat oval equivalent to those of United McGill Sheet Metal Company with gage and reinforcing as recommended by the manufacturer. Duct may be shop fabricated of completely welded construction in accordance with SMACNA Standards.
B. Oval ducts greater than 24 inch x 72 inch shall be longitudinal seam, flat oval duct, rolled, welded and provided in standard lengths of 5 and 10 feet. Transverse joints shall be factory welded or field connected with flanges or slip couplings. Duct will be fabricated from galvanized steel meeting ASTM A 527 standards.

C. Duct reinforcing angles shall be of sizes specified for same size rectangular duct. Galvanized angles shall be used where standing seams are specified for rectangular duct.

D. Oval fittings shall comply with requirements, sealing, etc., similar to that specified for round ductwork. Manifolding taps may be permitted without increasing the length of run in the branch duct system.

E. Elbows in oval ducts may be smooth long radius or 5-piece 90-degree elbows and 3-piece 45-degree elbows. Joints in sectional elbows shall be sealed as specified for duct sealing.

F. All exterior flat oval ductwork shall be double walled insulated ductwork. Refer to Section 23 33 13 Ductwork Insulation.

2.6 CONICAL BELLMOUTH FITTINGS AND TAPS

A. Conical bellmouth fittings shall be made from 26-gage G-90 coated galvanized steel. Two-piece construction with a minimum overall length of 6 inches and factory sealed for high-pressure requirements. Average of loss coefficient for sizes 6, 8 and 10 shall be less than 0.055.

B. Provide each fitting with minimum 24-gage damper plate with locking quadrant operator and sealed end bearings. Damper blade shall be securely attached to shaft to prevent damper form rotating around shaft. Shaft shall be extended to clear insulation.

C. Provide a flange and gasket with adhesive peel-back paper for ease of application. The fittings shall be further secured by sheet metal screws spaced evenly at no more than 4 inches on center with a minimum of four (4) screws per fitting.

D. Conical bellmouth fittings shall be Series 3000G as manufactured by Flexmaster U.S.A., Inc. or Buckley Air Products, Inc., “AIR-TITE”.

2.7 ELBOWS RECTANGULAR DUCTS

A. Construct elbows as follows in order of preference:
   1. Long radius, unvaned elbows.
   2. Short radius, single thickness vaned elbows.
   3. Rectangular, double thickness vaned elbows.

B. Long radius elbows shall have a centerline radius of not less than one and one-half (1-1/2) times the duct width. Short radius elbows shall have a centerline radius of not less than one times the duct width.

C. Contractor shall have the option to substitute short radius vaned elbows, but shall request the substitution at the time of submittal of Product Data.

D. Provide turning vanes in all rectangular elbows and offsets.

E. Job fabricated turning vanes, if used, shall be fabricated of the same gage and type of material as the duct in which they are installed. Vanes must be fabricated for same angle as duct offset. Submit Shop Drawings on factory fabricated and job fabricated turning vanes.

F. All turning vanes shall be anchored to the cheeks of the elbow in such a way that the cheeks will not breathe at the surfaces where the vanes touch the cheeks. In most cases, this will necessitate the installation of an angle iron support on the outside of the cheek parallel to the line of the turning vanes.

G. In 90-degree turns that are over 12 inches wide in the plane of the turn, provide and install double thickness vanes on integral side rails. For ducts under 12 inches in width, use single thickness vanes. The installation of the turning vanes shall be as described for single thickness vanes. On other types of turns or elbows, single thickness trailing edge vanes shall be used.

2.8 FLEXIBLE DUCT

A. Flexible duct shall be used where flexible duct connections are shown on the Drawings to air distribution devices and terminal units and as scheduled under “Ductwork System Applications.”
B. Acoustical Flexible Duct to Diffusers, Grilles, and Terminal Units:
1. Maximum flex duct length 6'-0" (six feet), installed with no more than 90 degrees of bend to diffusers and grilles. Where longer duct runs or more bends are necessary, provide rigid round ductwork.
2. Maximum flex duct length 2'-0" (two feet), installed as a straight run to the inlet of the terminal units.
3. Acoustical flexible duct shall be manufactured with an acoustically rated CPE inner film as the core fabric, mechanically locked by a corrosion-resistant galvanized steel helix.
4. Core shall be factory pre-insulated with a total thermal performance of R-3.5 or greater. Outer jacket shall be a fire retardant polyethylene vapor barrier jacket with a perm rating not greater than 0.10 per ASTM E 96, Procedure A.
5. Duct shall be rated for a minimum positive working pressure of 6 inches w.g. and a negative working pressure of 4 inches w.g. minimum.
6. Temperature range shall be –20 degrees F to 250 degrees F.
7. Duct must comply with the latest NFPA Bulletin 90A and be listed and labeled by Underwriter's Laboratories, Inc., as Class I Air Duct, Standard 181, and meet GSA, FHA and other U. S. Government standards; flame spread less than 25; smoke developed less than 50.
8. Acoustical flexible duct shall be similar to Flexmaster Type 8M for construction and acoustical performance standards.

C. Metal Flexible Duct:
1. May be used for terminal unit connections from sheet metal ductwork where shown on the Drawings.
2. Maximum length 2'-0" (two feet), installed in straight runs only. Where longer duct runs or direction changes are necessary, provide rigid round ductwork.
3. Duct shall be constructed of 0.005 inch thick 3003-H14 aluminum alloy in accordance with ASTM B209. Duct shall be spiral wound into a tube and spiral corrugated to provide strength and flexibility.
4. Core shall be factory pre-insulated with a total thermal performance of R-3.5 or greater. Outer jacket shall be fire retardant metalized vapor barrier jacket of fiberglass reinforced aluminum foil, with a permeance rating not greater than 0.05 per ASTM E96, Procedure A.
5. The duct shall be rated for a minimum positive and negative working pressure of 10 inch w.g.
6. Temperature range shall be –40 degrees F to 250 degrees F.
7. Duct must comply with the latest NFPA Bulletin 90A and be listed and labeled by Underwriter's Laboratories, Inc., as Class I Air Duct, Standard 181, and meet GSA, FHA and other U. S. Government standards; flame spread less than 25; smoke developed less than 50.
8. Metal flexible duct shall be similar to Flexmaster triple lock Type TL-M.

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 installation shall be in accordance with manufacturer's published recommendations.
C. Cleanliness:
1. Before installing ductwork, wipe ductwork to a visibly clean condition.
2. During construction, provide temporary closures of metal or taped polyethylene on open ductwork and duct taps to prevent construction dust or contaminants from entering ductwork system. Seal ends of ductwork prior to installation to keep ductwork interior clean. Remove closures only for installation of the next duct section.
3. During duration of construction, maintain the integrity of all temporary closures until air systems are activated.
D. Provide openings in ductwork where required to accommodate thermometers, controllers and other devices. Provide pitot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring. Sleeve of pitot tube opening shall be no more than one inch long. Opening shall be one inch wide to accept pitot tube.

E. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

F. Slope underground ducts to plenums or low pump out points at 1:500. Provide access doors for inspection.

G. Coat buried, metal ductwork without factory jacket with one coat and seams and joints with additional coat of asphalt base protective coating.

H. Set plenum doors 6 to 12 inches above floor. Arrange door swings so that fan static pressure holds door in closed position.

I. Provide residue traps in kitchen hood exhaust ducts at base of vertical risers with provisions for cleanout. Use stainless steel for ductwork exposed to view and stainless steel for ducts where concealed.

J. All visible welds in ductwork between biosafety cabinets, canopy hoods and fume hoods and the ceiling shall be ground and polished.

K. Slope duct toward grilles for moisture-laden ducts. Provide drain and trap at elbow of main moisture exhaust duct system.

L. Flexible Duct:
   1. The terminal ends of the duct core shall be secured by compression coupling or stainless steel worm gear type clamp.
   2. Fittings on terminal units and on sheet metal duct shall have flexible duct core slipped over duct and coupling or clamp tightened, then connection sealed with sealant. Insulation of flexible duct shall be slipped over connection to point where insulation abuts terminal unit or insulation on duct.
   3. These insulation connections shall be sealed by embedding fiberglass tape in the sealant and coating with more sealant to provide a vapor barrier.

M. Support flexible ducts as per SMACNA standards to prevent sags, kinks and to have 90 degree turns.

N. Hangers and Supports:
   1. All ductwork supports shall be in accordance with Table 4-1 (rectangular duct) and Table 4-2 (round duct) of the SMACNA Standards, with all supports directly anchored to the building structure.
   2. Rectangular duct shall have at least one pair of supports on minimum 8'-0" (eight feet) centers. All horizontal round and flat oval ducts shall have ducts hangers spaced 10'-0" (ten feet) maximum.
   3. Lower attachment of hanger to duct shall be in accordance with Table 4-4 of the SMACNA Standards.
   4. Vertical ducts shall be supported where they pass through the floor lines with 1-1/2 inch x 1-1/2 inch x 1/4 inch angles for duct widths up to 60 inches. Above 60 inches in width, the angles must be increased in strength and sized on an individual basis considering space requirements.
   5. Hanger straps on duct widths 60 inches and under shall lap under the duct a minimum of 1 inch and have minimum of one fastening screw on the bottom and two on the sides.
   6. Hanger straps on duct widths over 60 inches shall be bolted to duct reinforcing with 3/8 inch bolts minimum.

3.2 DUCTWORK SYSTEM CLEANING

A. If the system has been operated without scheduled filters or if the integrity of temporary closures has been compromised, Contractor shall have ductwork cleaned according to National Air Duct Cleaners Association (NADCA) Standards by a Certified Regular Member of the NADCA.
B. Before turning the installation over to the Owner, Contractor shall certify that the air handling systems have only been operated with scheduled filters in place. Otherwise, Contractor shall present evidence that the ductwork was cleaned as required above.

3.3 TESTING

A. All medium and high pressure duct systems (positive or negative) shall be pressure tested according to SMACNA test procedures (HVAC Air Duct Leakage Test Manual). Notify Owner minimum seven (7) calendar days in advance of leakage testing.

1. Design pressure for testing ductwork shall be determined from the maximum pressure generated by the fan at the nominal motor horsepower selected.
2. Total allowable leakage shall not exceed 1 percent of the total system design airflow rate.
3. When partial sections of the duct system are tested, the summation of the leakage for all sections shall not exceed the total allowable leakage.
4. Leaks identified during leakage testing shall be repaired by:
   b. Thorough cleaning of the joint surfaces.
   c. Installation of multiple layers of sealing materials.
5. The entire ductwork system shall be tested, excluding connections upstream of the terminal units (i.e. ductwork shall be capped immediately prior to the terminal units, and tested as described above).
6. After testing has proven that ductwork is installed and performs as specified, the terminal units shall be connected to ductwork and connections sealed with extra care. Contractor shall inform the Owner when joints may be visually inspected for voids, splits, or improper sealing of the joints. If any leakage exists in the terminal unit connections/joints after the systems have been put into service, leaks shall be repaired as specified for other leaks.

B. All low-pressure duct systems (positive or negative) shall be inspected for visible and audible signs of leakage.

1. Leaks identified by inspection shall be repaired by:
   b. Thorough cleaning of the joint surfaces.
   c. Installation of multiple layers of sealing materials.
2. Discrepancies found during testing and balancing between duct traverses and diffuser/grille readings shall result in re-inspection, repair and retest until discrepancies are eliminated.

C. Ductwork leakage testing and/or inspection shall be performed prior to installation of external ductwork insulation.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 & Division 20 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. Perform all Work required to provide and install the following ductwork accessories indicated by the Contract Documents with supplementary items necessary for proper installation.
      1. Airflow control dampers and spin-in fittings.
      2. Fire dampers, smoke dampers, and combination fire and smoke dampers.
      3. Flexible duct connections.
      4. Duct access doors.
      5. Screens
      6. Duct test holes.

1.3 REFERENCE STANDARDS
   A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
   B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
   C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:
      3. SMACNA - HVAC Duct Construction Standards.
      4. UL 33 - Heat Responsive Links for Fire-Protection Service.
      5. UL 555 – Standard for Fire Dampers.
      6. UL 555C – Standard for Ceiling Dampers.
      7. UL 555S – Standard for Smoke Dampers.

1.4 SUBMITTALS
   A. Product Data:
      1. Provide product data for shop fabricated assemblies including, but not limited to, volume control dampers, duct access doors, and duct test holes. Provide product data for hardware used.
      2. Fire Dampers: The damper manufacturer’s literature submitted for approval prior to the installation shall include performance data developed from testing in accordance with AMCA 500D standards and shall show the pressure drops for all sizes of dampers required at anticipated air flow rates. Maximum pressure drop through fire damper shall not exceed 0.05-inch water gauge.
      3. Combination Fire/Smoke Dampers: Assign identification numbers for each damper with corresponding number noted on Drawings. Provide air quantity, size, free area of damper, pressure drop and proposed velocity through each damper. Provide manufacturer’s data of damper and its accessories or options. At Owner’s request, provide two (2) dampers (18 inch x 12 inch) for the purpose of illustrating damper operation to Owner’s operating and maintenance personnel.
B. AEGB Submittal:
   1. Product data complying with Basic Requirements 7 - Low Emitting Materials – Interior Paints and Coatings
      a. Insulation containing no-added formaldehyde or ultra-low-emitting formaldehyde per CARB ATCM,
      b. VOC content for adhesives/sealants

PART 2 - PRODUCTS

2.1 GENERAL
   A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

2.2 MANUFACTURERS
   A. Dampers:
      1. Greenheck.
      2. Louvers and Dampers, Inc.
      4. Prefco.
      5. Ruskin.
   B. Regulators, Locking Quadrants:
      1. Ventfabrics.

2.3 AIR FLOW CONTROL DAMPERS
   A. Furnish and install dampers where shown on the Drawings and wherever necessary for complete control of airflow, including all supply, return, outside air, and exhaust branches, "division" in main supply, return and exhaust ducts, and each individual air supply outlet. Where access to dampers through a permanent suspended ceiling (gypsum board) is necessary, the Contractor shall be responsible for the proper location of the access doors.
   B. Dampers larger than three (3) square feet in area shall be controlled by a self-locking splitter damper assembly.
   C. Volume damper blades shall not exceed 48 inches (48") in length or twelve inches (12") in width and shall be of the opposed interlocking type. The blades shall be of not less than No. 16 gage galvanized steel supported on one-half inch (1/2") diameter rust-proofed axles. Axle bearings shall be the self-lubricating ferrule type.
   D. Volume dampers and other manual dampers shall be carefully fitted, and shall be manually controlled by damper regulators as follows:
      1. On exposed uninsulated ductwork the locking quadrant shall be made with a base plate of 16-gage cold-rolled steel and a heavy die cast handle designed with a 3/8 inch bearing surface. A 1/4 inch-20 zinc plated wing nut shall firmly lock the handle in place.
      2. On exposed externally insulated ductwork the regulator shall be 4-1/4 inch diameter, for 1/2 inch rod, designed for use on duct with insulation thickness specified for duct, and shall have four (4) 3/16 inch holes provided to rivet or screw regulator to the duct surface. The flange that covers the raw edge of the insulation shall be high enough so that it slightly compresses the insulation and holds insulation in place. The handle shall be 3/8 inch above the flange, and shall easily turn without roughing up the insulation.
      3. On concealed ductwork above inaccessible ceilings, the regulator shall be 2-5/8 inch diameter chromium plated cover plate that telescopes into the base, for 1/2 inch rod. Regulator shall be cast into a box for mounting in ceilings. Base shall be 1-1/2 inch deep. The cover shall be secured by two screws that can be easily removed for damper adjustment.
      4. Furnish and install end bearings for the damper rods on the end opposite the quadrant.
E. Spin-in fittings may be used for duct taps to air devices and shall include dampers on all duct to air devices (diffusers and grilles) even though a volume damper is specified for the air device. Spin-in fittings shall be similar to Flexmaster FLD with BO3 including a 2 inch buildout, nylon bushings, locking quadrant similar to Duro Dyne KR-3, and a 3/8 inch square rod connected to the damper with U-bolts. Spin-in fittings shall be sealed at the duct tap with sealant as specified herein. Determine location of spin-in fittings after terminal units are hung or after location of light fixtures are confirmed to minimize flexible duct lengths and sharp bends.

2.4 FIRE DAMPERS

A. Each fire damper shall be constructed and tested in accordance with Underwriters Laboratories Safety Standard 555, latest edition. Dampers shall possess a 1-1/2 hour or 3 hour (as appropriate for the construction shown in the architectural Drawings) protection rating, 160 or 165 degrees F fusible link, and shall bear a U.L. label in accordance with Underwriters' Laboratories labeling procedures. Construct fire dampers such that damper frame material and curtain material are galvanized.

B. Fire dampers shall be curtain blade type and damper shall be constructed so that the blades are out of the air stream to provide 100 percent free area of duct in which the damper is housed.

C. Equip fire dampers for vertical or horizontal installation as required by location shown on Drawings. Install fire dampers in wall and floor openings utilizing steel sleeves, angles and other material and practices as required to provide an installation equivalent to that utilized by the manufacturer when the respective dampers were tested by Underwriters Laboratories. Mounting angles shall be minimum 1-1/2 inch by 1-1/2 inch by 14 gage and bolted, tack welded or screwed to the sleeve at maximum spacing of 12 inches and with a minimum of two connections at all sides. Mounting angles shall overlap at least equal to the duct gage as defined by the appropriate SMACNA Duct Construction Standard, latest edition, and as described in NFPA 90A. The entire assembly, following installation, shall be capable of withstanding 6 inch water gauge static pressure.

D. All fire dampers shall be dynamic rated type.

E. Completely seal the damper assembly to the building components using manufacturer recommended material(s).

2.5 COMBINATION FIRE/SMOKE DAMPERS

A. Provide one damper motor for each 12 square feet of damper area.

B. Each combination fire/smoke damper shall be 1-1/2 hour fire rated under UL Standard 555, Current 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. Damper manufacturer shall have tested and qualified with UL, a complete range of damper sizes covering all dampers required by this Specification. Testing and UL qualifying a single damper size is not acceptable. The leakage rating under UL555S shall be no higher than Leakage Class II (4 CFM per square foot at one-inch water gauge pressure and 8 CFM per square foot at 4 inches water gauge pressure). Maximum air pressure drop through each combination fire/smoke damper shall not exceed 0.10-inch water gauge at the design air quantity. (Note that this may require a larger damper than the connected duct size.) All ratings shall be dynamic.

C. Damper frame shall be minimum 20-gage 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 an extruded hole in the frame or an extruded frame raceway. Dampers may be either parallel or opposed blade type. Blades shall be constructed with a minimum of 14-gage equivalent thickness. Blade edge seal material shall be able to withstand 450 degrees F. Jamb seals shall be flexible stainless steel compression type or lap seal type.
D. In addition to the leakage ratings specified herein, combination fire/smoke dampers and their operators shall be qualified under UL555S to an elevated temperature of 350 degrees F. Electric operators shall be installed by the damper manufacturer at the time of damper fabrication. Damper and operator shall be supplied as a single entity that meets all applicable UL555 and UL555S qualifications for both dampers and operators. Manufacturer shall provide a factory-assembled sleeve. Sleeve shall be minimum 20-gage for dampers where neither width nor height exceeds 48 inches or 16-gage where either dimension equals or exceeds 48 inches.

E. As part of the UL qualification, dampers shall have demonstrated a capacity to operate (open and close) under HVAC system operation conditions, with pressures at least 4 inches water gauge in the closed position, and 2500 fpm air velocity in the open position.

F. Each combination fire/smoke damper, except as noted hereinafter, shall be equipped with a UL Classified firestat/releasing device. The firestat/releasing device shall electrically (24 VAC) and mechanically (pneumatically) lock the damper in a closed position when the duct temperatures exceed 165 degrees F and still allow the appropriate authority to operate the damper as may be required for smoke control functions. Damper must be operable while the temperature is above 350 degrees F. Actuator/operator package shall include two damper position indicator switches linked directly to damper blade to provide capability of remotely indicating damper position. One switch shall close when the damper is fully open, and the other switch shall close when the damper is fully closed. The firestat/releasing device and position indicator switches shall be capable of interfacing electrically with the smoke detectors, building fire alarm system, and remote indicating/control stations or building automation system (BAS).

G. Damper releasing device shall be mounted within the airstream. Device shall be activated and the damper shall close and lock when subjected to duct temperatures in excess of approximately 285 degrees F.

H. Motors for operation of smoke dampers shall be smoke system fail safe, spring return normally open supplies and normally closed returns, or as indicated on the Drawings, and shall be furnished and installed by the damper manufacturer as required by the U.L. rating mentioned above. Motors shall be electric or pneumatic to match the type of temperature control system specified elsewhere in this Specification. Furnish all required relays, EP switches, wiring piping and other labor and material necessary to completely interconnect the smoke detector system.

I. Furnish each damper in a square or rectangular configuration. Furnish and install sleeves manufactured by the approved damper manufacturer for each damper. Construct sleeves with square or rectangular to square, rectangular, round, or oval adapters as required. Dampers shall be installed in the sleeves in accordance with manufacturer's U.L. installation instructions. The entire assembly, following installation, shall operate smoothly and be capable of withstanding 6 inch water gauge static pressure.

J. All combination fire/smoke dampers shall be dynamic type.

K. Completely seal the damper assembly to the building components using manufacturer recommended material(s).

2.6 SMOKE DAMPERS

A. Provide one damper motor for each 12 square feet of damper area.

B. Each smoke damper shall be dynamic rated type 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. Damper manufacturer shall have tested, and qualified with UL, a complete range of damper sizes covering all dampers required by this Specification. Testing and UL qualifying a single damper size is not acceptable. Leakage rating under UL555S shall be no higher than Leakage Class II (4 CFM per square foot at one-inch water gauge pressure and 8 CFM per square foot at 4 inches water gauge pressure). Maximum air pressure drop through each smoke damper shall not exceed 0.10-inch water gauge at the design air quantity. (Note that this may required a larger damper than the connected duct size.) All ratings shall be dynamic.
C. Damper frame shall be minimum 0.125-inch aluminum formed into a structural hat channel shape with corner braces for reinforcement, as approved in testing by Underwriters Laboratories. Bearings shall be stainless steel sleeve type turning in an extruded hole in the frame or an extruded frame raceway. Dampers shall be opposed blade type. Blades shall be airfoil shaped double skin construction. Blade edge seal material shall be silicone rubber designed to withstand 450 degrees F. Jamb seals shall be aluminum flexible metal compression type.

D. In addition to the leakage ratings specified herein, smoke dampers and their operators shall be qualified under UL555S to an elevated temperature of 350 degrees F. Pneumatic operators shall be installed by the damper manufacturer at the time of damper fabrication. Damper and operator shall be supplied as a single entity that meets all applicable UL555 and UL555S qualifications for both dampers and operators. Manufacturer shall provide factory-assembled sleeve. Sleeve shall be minimum 21-gage for dampers where neither width nor heights exceeds 48 inches or 16-gage where either dimensions equals or exceeds 48 inches.

E. 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 inches water gauge in the closed position, and 2000 fpm air velocity in the open position.

F. The damper must be operable while the temperature is above 350 degrees F. The actuator/operator package shall include two damper position indicator switches linked directly to damper blade to provide capability of remotely indicating damper position. One switch shall close when the damper is fully open, and the other switch shall close when the damper is fully closed. Position indicator switches shall be capable of interfacing electrically with the smoke detectors, building fire alarm systems, and remote indicating/control stations (BAS).

G. Motors for operation of smoke dampers shall be smoke system fail safe, spring return normally open supplies and normally closed returns, or as indicated on the Drawings, and shall be furnished and installed by the damper manufacturer as required by the UL rating mentioned above. Motors shall be electric or pneumatic to match the type of temperature control system specified elsewhere in this Specification. Furnish all required relays, EP switches, wiring piping and other labor and material necessary to completely interconnect the smoke detector system.

H. Furnish each damper in a square or rectangular configuration. Furnish and install sleeves manufactured by the approved damper manufacturer for each damper. Construct sleeves with square or rectangular to square, rectangular, round, or oval adapters as required. Install dampers in the sleeves in accordance with manufacturer's UL installation instructions. Entire assembly, following installation, shall operate smoothly and be capable of withstand 6 inch water gauge static pressure.

I. All smoke dampers shall be dynamic type.

J. Completely seal the damper assembly to the building components.

2.7 FLEXIBLE CONNECTIONS

A. Where ducts connect to, flexible connections shall be made using "Flexmaster TL-M" or "Ventglas" fabric that is temperature-resistant, fire-resistant, waterproof, mildew-resistant and practically airtight, weighing approximately thirty ounces (30 oz.) per square yard.

B. Material used outdoors shall be resistant to ultra-violet sunrays. There shall be a minimum of one-half inch (1/2-inch) slack in the connections, and a minimum of two and one-half inches (2-1/2-inch) distance between the edges of the . This does not apply to air handling units with internal isolation.

2.8 ACCESS DOORS

A. Furnish and install in the ductwork, hinged rectangular, pressure relief, or round "spin-in" access doors to provide access to all fire dampers, mixed air plenums, steam reheat coils (install upstream), automatic dampers, etc.

B. Where ductwork is insulated, access doors shall be double skin doors with one inch (1") of insulation in the door.
C. Where duct size permits, doors shall be eighteen inches (18") by sixteen inches (16"), or
eighteen inches in diameter, and shall be provided with Ventlok No. 260 latches (latches are
not required in round doors).
D. Latches for rectangular doors smaller than 18 inch x 16 inch shall be Ventlok No. 100 or 140.
E. Doors for zone heating coils shall be Ventlok, stamped, insulated access doors, minimum 10
inch x 12 inch, complete with latch and two (2) hinges, or twelve inches (12") in diameter.
F. Round access doors shall be "Inspector Series" spin-in type door as manufactured by
Flexmaster USA.
G. Doors for personnel access to ductwork shall be nominal twenty-four inches (24") in
diameter. Doors may be fabricated in a local approved sheet metal shop in accordance with
SMACNA Standards.
H. Where access doors are installed above a suspended ceiling, this Contractor shall be
responsible for the proper location of ceiling access doors.

2.9 SCREENS
A. Furnish and install screens on all duct, fan, etc., openings furnished by this Contractor which
lead to, or are located outdoors.
B. Screens shall be No. 16 gage, one-half inch (1/2") mesh in removable galvanized steel
frame.
C. Provide safety screens meeting OSHA requirements for protection of maintenance
personnel on all fan inlets and fan outlets to which no ductwork is connected.

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 installation shall be in accordance with manufacturer's published recommendations.
C. Provide balancing dampers at points on low pressure supply, return, and exhaust systems
where branches are taken from larger ducts as required for air balancing.
D. Provide all dampers furnished by the BAS Provider in strict accordance with manufacturer's
written installation instruction and requirements of these Specifications.
E. Provide fire dampers, and combination fire and smoke dampers at locations indicated, where
ducts and outlets pass through fire rated components. Install with required perimeter
mounting angles, sleeves, breakaway duct connections, corrosion resistant springs,
bearings, bushings and hinges.
F. Provide backdraft dampers on exhaust fans or exhausts ducts where indicated. Install
dampers so that they will open freely.
G. Provide flexible connections immediately adjacent to equipment in ducts associated with
fans and motorized equipment. Cover connections to medium and high pressure fans with
leaded vinyl sheet, held in place with metal straps.
H. Provide duct access doors for inspection and cleaning before and after duct mounted filters,
coils, fans, automatic dampers, at fire dampers, and elsewhere as indicated on Drawings.
Provide minimum 8 x 8 inch (200 x 200 mm) size for hand access, 18 x 18 inch (450 x 450
mm) size for shoulder access, and as indicated.
I. Provide duct test holes where indicated and where required for testing and balancing
purposes.
   1. Furnish and install Ventlok No. 699 instrument test holes in the return air duct and in
   the discharge duct of each fan unit.
   2. Install test holes in locations as required to measure pressure drops across each item
   in the system, e.g., outside air louvers, filters, fans, coils, intermediate points in duct
   runs, etc.
J. Access doors as specified elsewhere shall be provided for access to all parts of the fire and
combination fire and smoke dampers. Doors shall open not less than 90 degrees following
installation and shall be insulated type where installed in insulated ducts.
K. Install each fire and combination fire and smoke damper square and true to the building. The installation shall not place pressure on the damper frame, but shall enclose the damper as required by UL555 and UL555S.

3.2 TESTING
A. After each fire damper, smoke damper and combination fire and smoke damper has been installed and sealed in their prescribed openings and prior to installation of ceilings, Contractor shall, as directed by Owner, activate part or all dampers as required to verify “first-time” closure.
B. Activation of damper shall be accomplished by manually operating the resettable link, disconnecting the linkage at the fire damper fusible link, and manually operating the fire/smoke damper through the pneumatic or electronic controls as appropriate.
C. Failure of damper to close properly and smoothly on the first attempt will be cause to replace the entire damper assembly.
D. Coordinate smoke damper system interlock requirements with the fire alarm system.

END OF SECTION
SECTION 23 33 13

DUCTWORK INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 & Division 20 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. Perform all Work required to provide and install ductwork insulation and jackets indicated by the Contract Documents with supplementary items necessary for proper installation.

B. Conform with AEGB IEQ7 requirements. Insulation must not contain added formaldehyde resins (including urea, phenol, and urea-extended phenol).

1.3 REFERENCE STANDARDS

A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.

B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.

C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:

1. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
5. ASTM C612 - Mineral Fiber Block and Board Thermal Insulation.
16. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
17. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors.
18. UL 723 - Surface Burning Characteristics of Building Materials.
1.4 QUALITY ASSURANCE

A. All ductwork requiring insulation shall be insulated as specified herein and as required for a complete system. In each case, the insulation shall be equivalent to that specified and materials applied and finished as described in these Specifications.

B. All insulation, jacket, adhesives, mastics, sealers, etc., utilized in the fabrication of these systems shall meet NFPA for fire resistant ratings (maximum of 25 flame spread and 50 smoke developed ratings) and shall be approved by the insulation manufacturer for guaranteed performances when incorporated into their insulation system, unless a specific product is specified for a specific application and is stated as an exception to this requirement. Certificates to this effect shall be submitted along with Contractor’s submittal data for this Section of the Specifications. No material may be used that, when tested by the ASTM E84-89 test method, is found to melt, drip or delaminate to such a degree that the continuity of the flame front is destroyed, thereby resulting in an artificially low flame spread rating.

C. Application Company Qualifications: Company performing the Work of this Section must have minimum three (3) years experience specializing in the trade.

D. All insulation shall be applied by mechanics skilled in this particular Work and regularly engaged in such occupation.

E. All insulation shall be applied in strict accordance with these Specifications and with factory printed recommendations on items not herein mentioned. Unsightly, inadequate, or sloppy Work will not be acceptable.

1.5 SUBMITTALS

A. Product Data:
   1. Provide product description, list of materials, “k” value, “R” value, mean temperature range, and thickness for each service and location.

B. AEGB Submittal:
   1. Product data complying with Basic Requirements 7 - Low Emitting Materials – Interior Paints and Coatings
      a. Insulation containing no-added formaldehyde or ultra-low-emitting formaldehyde per CARB ATCM,
      b. VOC content for adhesives/sealants

C. Record Documents:
   1. Submit under provisions of Division 01.

D. Operation and Maintenance Data:
   1. Manufacturer’s Installation Instructions: Indicate procedures that ensure acceptable standards will be achieved. Submit certificates to this effect.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect, and handle products to the Project Site under provisions of Division 01 and Division 20.

B. Deliver materials to Site in original factory packaging, labeled with manufacturer’s identification including product thermal ratings and thickness.

C. Store insulation in original wrapping and protect from weather and construction traffic. Protect insulation against dirt, water, chemical, and mechanical damage.

D. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics and insulation cements.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
2.2 MANUFACTURERS
A. CertainTeed Corporation.
B. Johns Manville Corporation.
C. Knauf Corporation.
D. Owens-Corning.
E. Armacell North America.
F. Unifrax 1 LLC. (FyreWrap)

2.3 INSULATION MATERIALS
A. Type D1: Flexible glass fiber; ASTM C553 and ASTM C1290; commercial grade; 'k' value of 0.25 at 75 degrees F; 1.5 lb/cu ft minimum density; 0.002 inch foil scrim kraft facing for air ducts.
B. Type D2: Rigid glass fiber; ASTM C612, Class 1; 'k' value of 0.23 at 75 degrees F; 3.0 lb/cu ft minimum density; 0.002 inch foil scrim kraft facing for air ducts.
C. Type D3: Ductliner (to be used in return air sound boots only), flexible glass fiber; ASTM C1071; Type II, 'k' value of 0.23 at 75 degrees F; 3.0 lb/cu ft minimum density; coating air side for maximum 4,000 feet per minute air velocity. The airstream surface must be protected with a durable acrylic surface coating specifically formulated to:
   1. Be no more corrosive than sterile cotton when tested in accordance with the test method for corrosiveness in ASTM C665.
   2. Absorb no more than 3 percent by weight when tested in accordance with the test method for moisture vapor sorption in ASTM C1104.
   3. Not support the growth of fungus or bacteria, when tested in accordance with the test method for fungi resistance in ASTM C1071, ASTM C1338, ASTM G21, and ASTM G22.
   4. Show no signs of warpage, cracking, delaminating, flaming, smoking, glowing, or any other visibly negative changes when tested in accordance with the test method for temperature resistance in ASTM C411.
   5. Have a flame spread rating of 25 or less and a smoke developed rating of 50 or less when tested in accordance with the test method for surface burning in ASTM E 84.
   6. Meet the sound absorption requirements when tested in accordance with the test method for sound absorption in ASTM C423.
   7. Show no evidence of continued erosion, cracking, flaking, peeling, or delamination when tested in accordance with the test method for erosion resistance in UL181.
D. Type D5: Outdoor Duct Application – Type D1 Insulation with externally wrapped galvanized sheet metal jacket with seams located on bottom side of horizontal duct section.
   1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive to match jacket.
   2. Secure insulation without vapor barrier with staples, tape, or wires.
   3. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.
   4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
   5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
   6. Slope jacket to prevent water pooling.

2.4 INSULATION ACCESSORIES
A. Adhesives: Waterproof vapor barrier type, meeting requirements of ASTM C916; Childers CP-82.
B. Finish: Vapor barrier finish coating, Childers CP-11.
C. Jacket: Pre-sized glass cloth, minimum 7.8 oz/sq yd.
D. Type D4 Insulation Adhesive: Fire resistive to ASTM E84, Childers CP-82.
E. Impale Anchors: Galvanized steel, 12 gage self-adhesive pad.
F. Joint Tape: Glass fiber cloth, open mesh.
PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that ductwork has been tested before applying insulation materials.
B. Verify that surfaces are clean, foreign material removed, and dry.

3.2 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 manufacturer’s published recommendations.
C. Extend duct insulation without interruption through walls, floors, and similar penetrations, except where otherwise indicated.
D. Provide external insulation on all round ductwork connectors to ceiling diffusers and on top of diffusers as indicated in the Ductwork Insulation Application and Thickness Schedule and the Drawings. Secure insulation to the top of ceiling diffusers with adhesive that meets NFPA 90A and 90B 25/50 requirements, and vapor barrier or tape to match jacket. Do not insulate top of ceiling diffuser if it is used in ceiling return air plenum or in an open space with no ceiling.
E. Flexible and Rigid fiberglass insulation (Types D1 and D2) application for exterior of duct:
   1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
   2. Install without sag on underside of ductwork. Use 4-inch wide strips of adhesive on 8-inch centers and mechanical fasteners where necessary to prevent sagging. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
   3. Insulate standing seams and stiffeners that protrude through the insulation with 1-1/2 inch thick, unfaced, flexible blanket insulation. Cover with glass cloth and coat with vapor barrier finish coating.
   4. On circumferential joints, the 2-inch flange on the facing shall be secured with 9/16 inch outward clinch steel staples on 2-inch centers, and taped with minimum 3-inch wide strip of glass fabric and finish coating.
   5. Cover seams, joints, pin penetrations and other breaks finish coating reinforced with glass cloth.
F. Duct Liner (Type D3) application for interior of return air sound boots:
   1. Secure insulation with 100 percent coverage of lagging adhesive, pins and clips not more than 18 inches on center.
   2. Secure bottom of duct insulation using alternate single and double clips. The first pin will secure the insulation and the second clip will be used to secure the cladding. Isolate the exterior clip from the cladding by using two 1/8 inch closed cell neoprene (Armaflex) washers on either side of the cladding. Predrill holes in cladding and avoid contact with pin during installation.
   3. For round duct, secure insulation with 100 percent coverage of lagging adhesive. Secure cladding with 3/4 inch, 0.020 inch stainless steel bands on 12-inch centers.
   4. For joints and overlaps, fold cladding to form a double thickness hem 2 inches minimum. Seal with a non-shrink, non-hardening sealing compound.
G. Insulation (Type D5) application for outdoor ducts:
1. Horizontal ductwork located outdoors shall be sloped at a minimum 2-degree angle to prevent the accumulation of water on top of the finished insulated duct. Support members that connect directly to the ductwork are to be insulated with this same material. Keep compression or sharp creases of outdoor insulation to a minimum by distributing the weight of the duct resting on horizontal duct support members.

2. Follow the insulation manufacturer's installation instructions and procedures to assure the ductwork is properly insulated and that the insulation will meet the manufacturer’s warranty requirements.

H. All ductwork, accessories, and all plenums including metal and masonry construction, etc., shall be insulated as indicated on the Drawings, as specified herein and as required for a complete system. In each case, the insulation shall be equal to that specified and materials applied and finished as described in these Specifications.

I. Flexible ductwork connections to equipment shall not be insulated.

J. Where vapor barriers are required, the vapor barrier shall be on the outside. Extreme care shall be taken that the vapor barrier is unbroken. Joints, etc., shall all be sealed. Where insulation with a vapor barrier terminates, it shall be sealed off with the vapor barrier being continuous to the surface being insulated. Ends shall not be left raw.

K. Extreme care shall be taken in insulating high and medium pressure ductwork including all ductwork between the fan discharge and all mixing boxes to ensure the duct is not pierced with sheet metal screws or other fasteners. All high and medium pressure ducts in these Specifications are classified as high velocity ductwork.

L. Where canvas finish is specified use lagging adhesive to prevent mildew in securing canvas. Do not use wheat paste. In addition, cover all canvas insulation with a fire retardant coating.

M. All ductwork in the Project except toilet exhaust ductwork, shall be insulated externally unless specifically excluded.

N. Flexible round ducts shall be factory insulated.

3.3 INSPECTION

A. Visually inspect the completed insulation installation per manufacturers recommended materials, procedures and repair or replace any improperly sealed joints.

B. Where there is evidence of vapor barrier failure or "wet" insulation after installation, the damaged insulation shall be removed, duct surface shall be cleaned and dried and new insulation shall be installed.

3.4 DUCTWORK INSULATION APPLICATION AND THICKNESS SCHEDULE

<table>
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<tr>
<th>Ductwork System</th>
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<th>Insulation Type</th>
<th>Insulation Thickness</th>
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<td>Supply Air (Hot, Cold, Combination)</td>
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<td>D1</td>
<td>2&quot;</td>
<td></td>
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<tr>
<td></td>
<td>Inside of Mechanical Rooms</td>
<td>D2</td>
<td>2&quot;</td>
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<tr>
<td>Return Air, Relief Air, and Exhaust Air</td>
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<td>D1</td>
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<td>Outside Air</td>
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<td>Top of Diffuser</td>
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<td>Outdoor Environment</td>
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<tr>
<td>Return, Exhaust Air Duct</td>
<td>Outdoor Environment</td>
<td>D5</td>
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<tr>
<td>Return Air Sound Boots/Elbows</td>
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<td>D3</td>
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SECTION 23 34 23

POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 & Division 20 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. Perform all Work required to provide and install the following fans indicated by the Contract Documents with supplementary items necessary for proper installation.
   1. Centrifugal roof, up-blast, and sidewall exhauster.
   2. Centrifugal roof supply fan.
   3. Inline centrifugal fans.
   4. Make-up air unit.
   5. Motors and drives.
   6. Fan accessories.

1.3 REFERENCE STANDARDS
A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:
   1. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
   2. AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
   5. AMCA 204 - Balance Quality and Vibration Levels For Fans.
   8. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
   9. NEMA MG1 - Motors and Generators.
   11. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
   12. UL 705 – Power Ventilators.

1.4 QUALITY ASSURANCE
A. Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.
B. Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal. The sound power levels must not exceed those indicated on Drawings.
C. Fabrication: Conform to AMCA 99.
D. Performance Base: 50 feet above sea level.
E. Static and Dynamic Balance: Eliminate vibration or noise transmission to occupied areas.
F. Fans shall be capable of operating stably at reduced loads imposed by means of variable speed drives, inlet guide vanes or controlling pitch of fan blades.
1.5 SUBMITTALS

A. Product Data:
   1. Submittal data for approval for all fans of every description furnished under this section of these Specifications.
   2. Provide literature that indicates dimensions, weights, capacities, ratings, fan performance, gages and finishes of materials, special coatings and construction, electrical characteristics and connection requirements.
   3. Fan curves with specified operating point clearly plotted. The recommended range of operation shall be stable.
   4. Data on sound power levels for both fan inlet and outlet at rated capacity.
      a. Data on special coatings and construction where applicable.
   5. Electrical characteristics and connection requirements. All data on fan accessories.

B. Operation and Maintenance Data:
   1. Manufacturer's installation instructions and operating and maintenance data.
      a. Submit under provisions of Division 01.
      b. Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products to the Project Site under provisions of Division 01 and Division 20.
B. Accept products on Site in factory-fabricated protective containers or coverings, with factory-installed shipping skids and lifting lugs. Inspect for damage.
C. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.
D. Check and maintain equipment on a monthly basis to ensure equipment is being stored in accordance with manufacturer’s recommended practices. Additionally, during each check, fans and motors shall be rotated and greased and shafts shall be left approximately 180 degrees from that of previous month. Maintain storage records that indicate these maintenance requirements have been met.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
B. Fans shall be either belt or direct drive as scheduled on Drawings.
C. Select fans such that they do not increase motor size, increase noise level, or increase tip speed by more than 10 percent, or increase inlet air velocity by more than 20 percent, from specified criteria. Provide fans capable of accommodating static pressure variations of plus or minus 10 percent.
D. Statically and dynamically balance fans to eliminate vibration or noise transmission to occupied areas.
E. Coat all parts of fan housing, blades, etc., exposed to corrosive air stream with specified material to handle environmental conditions.
F. Motors and Drives: Provide motors and drives as required in this Section and as scheduled on Drawings.
G. Finishes: Provide finishes as required in this Section for manufacturer and Site-applied as scheduled on Drawings.
H. Accessories: Provide with accessories as require in this Section and as scheduled on Drawings.

2.2 MANUFACTURERS

A. Carnes.
B. Greenheck.
2.3 CENTRIFUGAL ROOF, UPBLAST, AND SIDEWALL EXHAUSTER
A. Backward inclined fan wheel with spun aluminum housing; resilient mounted motor and drive assembly; 16 gage aluminum birdscreen; square base to suit roof curb with continuous curb gaskets; secured to roof curb with cadmium plated or stainless steel bolts and screws.
B. Roof Curb: Roof curb shall be coordinated with Owner and Contractor.
C. Backdraft Damper: Gravity activated or motorized as indicated. Where type is not indicated on Drawings or Specifications, provide gravity-activated damper. Aluminum construction, felt edged with nylon bearings.
D. Upblast exhausters shall have integral drain trough.
E. Apply three coats of air-dried Heresite coating by fan manufacturer both internal and external to all roof exhausters for corrosive applications.

2.4 CENTRIFUGAL ROOF SUPPLY FAN
A. Forward curved, double width double inlet, with heavy gage galvanized steel housing; resiliently mounted motor and drive assembly.
B. Backdraft Damper: Gravity activated or motorized as indicated. Where type is not indicated on Drawings or Specifications, provide gravity-activated damper. Aluminum construction, felt edged with nylon bearings.
C. Roof Curb: Roof curb shall be coordinated with Owner and Contractor.
D. Filters: 1-inch washable, aluminum, permanent type as furnished with unit.
E. Hood shall be easily removable for service.

2.5 INLINE CENTRIFUGAL FANS
A. Backward inclined centrifugal fan wheel, mounted in a rectangular housing for ducted application. Direct-drive or belt-drive as scheduled on Drawings.
B. Wheel: Single width, single inlet, steel or aluminum construction with smooth curved inlet flange, heavy backplate, backwardly inclined or curved blades welded or riveted to flange and backplate; cast aluminum or cast steel hub riveted to backplate and keyed to shaft with set screws and key.
C. Housing: Bolted or bolted and welded steel construction with spun, aerodynamic inlet cone for plenum-type fan wheel. Housing shall be configurable for ducted side or front discharge. Side panels shall be removable for access to the fan wheel and bearings.

2.6 ACCESSORIES
A. Adjustable Inlet Vanes: Steel construction with blades supported at both ends with two permanently lubricated bearings, variable mechanism out of air stream terminating in single control lever with control shaft for double width fans and locking quadrant.
B. Inlet Bell: Bell mouth inlet fabricated of steel with flange.
C. Outlet Cones: Fabricated of steel with flanges, outlet area/inlet area ratio of 1.5/1.0, with center pod as recommended by manufacturer.
D. Dampers: Welded steel construction consisting of two semi-circular vanes pivoted on oil retaining bearings in short casing section, finished by hot dip galvanizing. Provide motor actuation.
E. Thrust Restraints: Provide thrust restraints where thrust exceeds fan weight for vane and axial fans.
F. Inlet/Outlet Screens: Galvanized steel welded grid. Provide where inlet or outlet are unducted.
G. Access Doors: Shaped to conform to housing with quick opening latches and gaskets.
H. Cover: Provide weatherproof cover for motor and drive where fans are exposed to the weather.
I. Extended Wiring: Provide extended wiring for electrical connection at the exterior of the unit for all direct drive applications.

2.7 FACTORY-APPLIED FINISHES
A. Wheels and Impellers: Steel components shall be finished with a thermally fused polyester coating. Other finishes as required on Drawings.
B. Housings:
   1. Interior Fans: Thermally fused polyester coating for steel. Prime coating is not required for aluminum housings.

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 installation shall be in accordance with manufacturer's published recommendations. Do not operate fans for any purpose until ductwork is clean, filters in place, bearings lubricated and fan has been test run under observation.
C. Roof Curbs: Roof curb installation shall be coordinated with Owner and Contractor.
D. Install flexible connections specified in Section 23 33 00 between fan inlet and discharge ductwork. Ensure metal bands of connectors are parallel with minimum one-inch flex between ductwork and fan while running.
E. Install fan restraining snubbers as required. Refer to Section 20 05 48. Adjust snubbers to prevent tension in flexible connectors when fan is operating.
F. Provide backdraft dampers on discharge of exhaust fans where indicated. Refer to Section 23 33 00.
G. Install fans with resilient mountings and flexible electrical leads. Refer to Section 20 05 48.
H. Disconnect Switches: Disconnect switches shall be installed adjacent to fan on unistrut per Division 26. Coordinate installation with Owner.

3.2 PAINTING
A. Provide equipment with factory finish in accordance with the manufacturer's standards. Touch up scratches and marks from handling and installation with masking enamel to match manufacturer's color.
B. Refer to Division 09 for Site-applied finishes.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary
   Conditions and Division 01 & Division 20 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. Perform all Work required to provide and install the following products as indicated by the
   Contract Documents with supplementary items necessary for proper installation.
1. Single duct variable or constant volume terminal units.
2. Integral heating coils.
3. Integral controls.
4. Integral sound attenuator.

1.3 REFERENCE STANDARDS
A. The latest published edition of a reference shall be applicable to this Project unless identified
   by a specific edition date.
B. All reference amendments adopted prior to the effective date of this Contract shall be
   applicable to this Project.
C. All materials, installation and workmanship shall comply with the applicable requirements and
   standards addressed within the following references:
   2. UL 181 - Factory-Made Air Ducts and Connectors.
   3. ARI Standard 880 for Air Terminals.
   4. ANSI/ASHRAE Standard 130 – Methods of Testing for Rating Ducted Air Terminal
      Units.

1.4 SUBMITTALS
A. Product Data:
   1. Shop Drawings of product data indicating configuration, general assembly, access
      space required for service, and materials used in fabrication.
   2. Electronic or Printed Catalog performance ratings that indicate nominal inlet size, CFM,
      applicable static pressure at the inlet or discharge of terminal unit, and noise criteria
      with sound octave band and sound decibel test in accordance with ARI 880, for the
      insulation lining selected.
   3. Leakage curves indicating inlet static pressure and actual tested leakage rates shall be
      submitted for all non-standard or custom-built terminal units.
   4. Unit manufacturer shall test and certify that each terminal unit used on this Project has
      been tested as specified.
B. Record Documents:
   1. Submit under provision of Division 01.
C. Operation and Maintenance Data:
   1. Operating instructions and maintenance manuals indicating maintenance and repair
      data, parts lists.
D. AEGB Submittal:
   1. Product data complying with Basic Requirements 7 - Low Emitting Materials – Interior
      Paints and Coatings
      a. Insulation containing no-added formaldehyde or ultra-low-emitting formaldehyde per
         CARB ATCM,
      b. VOC content for adhesives/sealants
1.5 SHIPMENT TESTING PRIOR TO INSTALLATION

A. Shipment Testing: At the Owner’s discretion, a minimum of ten (10) percent of each size single duct terminal unit (but no less than one unit of each size on the Project) will be tested at the Project Site for casing leakage and damper leakage. Fan powered terminals units will be tested for damper leakage and for conformance to this Specification. Contractor shall allow sufficient time during construction for the TAB Firm to perform all testing as may be required.

B. Unit Non-Performance:
   1. If results of the shipment testing show that any of the units do not perform as specified, then an additional ten (10) percent of each size unit (but no less than one unit of a size, unless 100 percent of the size has been tested) shall be tested.
   2. If this testing, in the Owner’s opinion, shows that ten (10) percent or more of the units tested do not perform as specified, then 100 percent of all unit sizes shall be tested for conformance with these Specifications.
   3. The results of that testing shall be reviewed carefully between the Contractor, manufacturer, Owner, and Engineer. A method of repair or replacement of units will be negotiated. The Owner, however, shall maintain the right of final approval of any proposed solution.

C. Should for any reason, the testing as described in this Section prove that any of the units do not perform as specified, Contractor shall be responsible for all subsequent labor, travel, travel expenses and incidental expenses, penalties, or other costs attendant to any additional testing as described in this Section, or as required to prove that the units perform as specified. This shall include, but not be limited to, the labor, travel and reasonable incidental expenses of not only the Contractor and TAB Firm, but also those incurred by the Owner as may be specifically required for this purpose.

1.6 WARRANTY

A. Provide one year manufacturer’s warranty under provisions of Division 01.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

2.2 MANUFACTURERS

A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three (3) years documented experience.

B. The same manufacturer shall provide all products supplied and/or installed under this Section.

C. Manufacturers:
   1. Nailor Industries.
   2. Titus.

2.3 VAV AIR TERMINAL UNITS

A. Configuration: Volume-damper assembly inside unit casing with control components inside a protective metal shroud.

B. Casing: 20 gauge steel
   1. Casing Lining: 1/2-inch thick, coated, fibrous-glass duct liner complying with ASTM C 1071; secured with adhesive.
   2. Air Inlets: Round stub connections or S-slip and drive connections for duct attachment.
   3. Air Outlet: S-slip and drive connections.
   4. Access: Removable panels for access to dampers and other parts requiring service, adjustment, or maintenance; with airtight gasket and quarter-turn latches.

C. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.
   1. Maximum Damper Leakage: ARI 880 rated, 2 percent of nominal airflow at 3-inch wg inlet static pressure.
D. Factory-Mounted and -Wired Controls: Electrical components shall be mounted in control box with removable cover. Incorporate single-point electrical connection to power source.

1. Control Transformer: Factory mounted for control voltage on electric and electronic control units with terminal strip in control box for field wiring of thermostat and power source.

2. Wiring Terminations: Controls connected to terminal strip, and terminal lugs shall match quantities, sizes, and materials of branch-circuit conductors. Enclose terminal lugs in terminal box that is sized according to NFPA 70.

E. Control Panel Enclosure: NEMA 250, Type 1, with access panel sealed from airflow and mounted on side of unit.

F. Hot Water Heating Coil:

1. Hot water coils installed in conjunction with terminal units as scheduled on the Drawings shall be factory installed, one or two row with a maximum of 10 aluminum fins per inch. Airside pressure drop shall be limited to 0.2 inches w.g. at unit rated cold airflow water pressure drop shall not exceed five feet water gauge. Construct and test coils in accordance with UL and/or ARI Standards.

2. Provide full fin collars for accurate fin spacing and maximum fin-to-tube contact. Tubes shall be ½ inch diameter seamless copper with minimum wall thickness of 0.015 inches, leak tested at 300 psig air pressure under water.

3. Provide male sweat-type water connections.

4. Side and end plates shall be minimum 20 gage galvanized sheet metal construction.

5. Protect tube ends with tube end caps of sheet metal similar to casing material. Insulate within the caps. Contractor shall insulate tube sheets and coil casings in same manner as adjacent ductwork.

2.4 GENERAL

A. Unit Controls:

1. General Performance: Flow stations, control transformers, disconnect switch, and controls enclosure shall be furnished, mounted and adjusted by the terminal unit manufacturer to assure their proper placement within the units. If DDC controls of another manufacturer (not the terminal unit manufacturer) are provided for the Project, the terminal unit manufacturer shall be responsible only for construction of the terminal unit and installation of internal control components installed at the manufacturer’s factory and shall not be responsible for installation of controls not installed at the terminal unit manufacturer’s factory, nor shall the manufacturer be responsible for the performance of the DDC controls. The performance of DDC controls in connection with terminal units shall be the responsibility of the BAS Provider.

2. Control Performance: Assemblies shall be able to be reset to any airflow between zero and the maximum CFM shown on Drawings. To allow for maximum future flexibility, it shall be necessary to make only simple screwdriver or keyboard adjustments to arrange each unit for any maximum airflow within the ranges for each inlet size as scheduled on the Drawings. The control devices shall be designed to maintain the desired flow regardless of inlet flow deflection.

3. Control Sequences: The control sequence arrangements shall be as described on the Drawings. Terminal units shall be shipped from the manufacturer with all necessary control devices to accomplish each sequence, except as may be prohibited by the BAS Provider. The desired sequence shall be adjustable according to space usage or a change in space conditions.

B. DDC Controls Protocol/Description:

1. BAS Provider will be responsible for providing all damper actuators, linkages, flow transducers, controllers, room temperature sensors, and any other devices required for unit control, except as specified below.

2. BAS Provider will be responsible for calibrating the actuator and its controller through TAB work for scheduled airflow rates. Units shall be capable of field calibration and readjustment with external gauge taps.

3. Unit manufacturer shall provide unit inlet flow sensor and pneumatic tubing for BAS Provider’s use.
4. Unit manufacturer shall factory install all devices furnished by BAS Provider to result in a complete functioning unit. Unit manufacturer shall be responsible for reviewing compatibility of devices furnished by BAS Provider to units provided.

C. Pressure and Leakage Certification:
   1. Manufacturer shall certify that each unit used on the Project will perform as specified. Each unit shall bear a tag or decal listing the following specified information:
      a. Test pressure.
      b. Leakage CFM (damper).
      c. Leakage CFM (casing except fan-powered units).
      d. Date of manufacture.
      e. Name of person performing test.

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 installation shall be in accordance with manufacturer’s published recommendations.

C. 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.).

D. Provide ceiling access doors or locate units above easily removable ceiling components.

E. Install terminal units with a minimum of four (4) diameters of straight duct directly prior to the entry into each terminal unit connection.

F. Support units individually from structure. Do not support from adjacent ductwork. For terminal units that are not internally isolated Refer to Section 20 05 48 for terminal unit vibration isolation requirements. Terminal units shall be supported using units hanger brackets and threaded rods.

G. Connect to ductwork in accordance with Section 23 31 00.

H. Wiring and controller compartments, electronic motors and damper motors shall have a minimum 24 inch clear wide and deep working space readily accessible from lift out ceiling tiles or access panels.

END OF SECTION
SECTION 23 37 00
AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 & Division 20 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. Perform all Work required to provide and install diffusers, diffuser boots, registers/grilles, louvers, louver penthouses, roof hoods, and goosenecks indicated by the Contract Documents with supplementary items necessary for proper installation.

1.3 REFERENCE STANDARDS
A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:
   1. AMCA 500 - Test Method for Louvers, Dampers and Shutters.
   5. SMACNA 1035 - HVAC Duct Construction Standards - Metal and Flexible.

1.4 QUALITY ASSURANCE
A. Test and rate performance of air outlets and inlets in accordance with ASHRAE 70.
B. Test and rate performance of louvers in accordance with AMCA 500.

1.5 SUBMITTALS
A. Product Data:
   1. Submit product data and Shop Drawings, indicating type, size, location, application, noise level, finish, and type of mounting.
   2. Review requirements of outlets and inlets as to size, finish, and type of mounting prior to submitting product data.
B. Operation and Maintenance Data:
   1. Submit manufacturer’s installation instructions under provisions of Division 01.

PART 2 - PRODUCTS

2.1 GENERAL
A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
B. Grilles, registers and diffusers shall be as scheduled on the Drawings. Grilles, registers and diffusers shall be provided with sponge rubber or soft felt gaskets where noted on the Drawings. If a manufacturer other than the one scheduled is used, the sizes shown on the Drawings shall be checked for performance, noise level, face velocity, throw, pressure drop, etc., before the submittal is made. Selections shall meet the manufacturer's own published data for the above performance criteria. The throw shall be such that the velocity at the end of the throw in the five (5) foot occupancy zone will not exceed 50 fpm nor be less than 25 fpm except where indicated otherwise. Noise levels shall not exceed those published in ASHRAE for the type of space being served (NC level). In the vicinity of lab hoods, terminal velocity at face of hood shall not exceed 20 fpm.

C. Locations of air distribution devices on Drawings are approximate and shall be coordinated with other trades to make symmetrical patterns and shall be influenced by the established general pattern of the lighting fixtures or architectural reflected ceiling plan, but primarily located to maintain proper air distribution. Where called for on Drawings, grilles, registers and diffusers shall be provided with deflecting devices and manual dampers. These grilles, registers, and diffusers shall be the standard product of the manufacturer, and subject to review by the Architect.

D. Coordinate color and finish of the devices with the Architect.

2.2 MANUFACTURERS

A. Grilles, Registers, and Diffusers:
   1. Titus Products.
   2. Price Industries.

B. Louvers:
   1. Ruskin.
   2. Greenheck.
   3. Arrow.

C. Roof Hoods:
   1. Greenheck.
   2. Cook.
   3. Acme.

2.3 ROUND CEILING DIFFUSERS

A. Round, adjustable pattern, stamped or spun, multicore type diffuser to discharge air in 360-degree pattern, with sector baffles where indicated.

B. Project diffuser collar above ceiling face and connect to duct with duct ring. In plaster ceilings, provide plaster ring.

C. Fabricate of aluminum, unless otherwise noted, with factory baked enamel, off-white finish.

D. Provide multi-louvered equalizing grid where NOTED ON DRAWINGS.

2.4 RECTANGULAR CEILING DIFFUSERS

A. Rectangular, full louvered face, directional, removable multi-core type diffuser to discharge air in 360-degree pattern. Neck size shall be as scheduled on the Drawings. Provide filler panels, where required, for directional throw diffusers.

B. Fabricate frame and blades of extruded aluminum with factory baked enamel, off-white finish.

C. Provide multi-louvered equalizing grid where noted on Drawings.

D. Provide round neck connection as scheduled on DRAWINGS.

2.5 PERFORATED FACE CEILING DIFFUSERS

A. Perforated face with fully adjustable pattern and removable face.

B. Fabricate of aluminum with factory baked enamel, off-white finish.

C. Provide multi-louvered equalizing grid where noted on Drawings.

D. Provide round neck connection as scheduled on Drawings.
2.6 SQUARE PANEL FACE SUPPLY AND RETURN AIR CEILING DIFFUSER
A. Architectural diffuser with a square panel centered within a square housing similar to the Titus OMNI model. Drawings that depict two-way and three-way throw options are achieved with the use of filler panel (where required) for directional throw diffusers.
B. Opposed blade volume dampers shall be provided with the diffuser, if scheduled on the Drawings. The volume damper design shall be similar to the Titus AG-75.
C. Although the manufacturers show this model being used only as a supply air device, this same diffuser can also be used as a return air device. The neck connection shall be the largest available neck size provided by the manufacturer.
D. Provide round neck connection as scheduled on Drawings.

2.7 CEILING EXHAUST AND RETURN REGISTERS/GRILLES
A. Streamlined blades, depth of which exceeds 3/4-inch spacing, with spring or other device to set blades, vertical face.
B. Fabricate 1-inch margin frame with concealed mounting.
C. Fabricate of steel with minimum 20 gage frames and minimum 22 gage blades, steel and aluminum with minimum 20 gage frame, or aluminum extrusions, with factory baked enamel finish.
D. Opposed blade damper with removable key operator, operable from face shall only be provided with the grille when it is scheduled on the Drawing.

2.8 PERFORATED FACE RETURN/EXHAUST GRILLES
A. Perforated face with back pan, removable face, and neck sizes as indicated on Drawings.
B. Provide frame type as indicated on Drawings.
C. Fabricate completely of 22 gage steel with a baked enamel off-white finish.

2.9 PERFORATED FACE CEILING EXHAUST AND RETURN REGISTERS/GRILLES
A. 0.0375-inch stainless steel non-aspirating perforated panels with stainless steel plenum for low-velocity applications.
B. Provide quick-opening fasteners with safety chains.
C. Provide multi-louvered equalizing grid where noted on Drawings.

2.10 CEILING EGG CRATE EXHAUST AND RETURN REGISTERS/GRILLES
A. Fixed series of cubes comprised of 1/2 x 1/2 x 1-inch aluminum strips.
B. Fabricate one-inch margin aluminum frame.
C. Fabricate of aluminum with factory baked enamel finish.
D. Provide square uniform height plenum for ducted return and exhaust application of scheduled neck size.

2.11 CEILING LINEAR SLOT DIFFUSERS
A. Continuous linear flow bar slot with adjustable vanes for left, right, or vertical discharge, with volume control. Provide slot width, length and number of slots as scheduled on the Drawings.
B. Fabricate of aluminum extrusions with factory baked enamel finish.
C. Provide support clips and gasket as required for ceiling system.
D. Provide alignment strips for hairline joints and end caps where the slot terminates. Provide mitered corners.
E. Provide black matte finish for all interior exposed-to-view components.
F. Provide externally insulated supply air plenum by diffuser manufacturer.
G. Provide return slot diffuser same as supply, except without the adjustable vane control. Provide return air plenum for ducted return where indicated on Drawings.
2.12 PLENUM SLOT SUPPLY AND RETURN DIFFUSERS
A. Supply or return plenum slot, 3/4-inch, with single extruded aluminum curved deflector blade to create a tight horizontal airflow pattern across the ceiling. Provide slot width, length, and number of slots as scheduled on the Drawings.
B. Diffusers shall discharge air horizontally through two outside sections and vertically through a center down-blow section.
C. Standard nominal lengths shall be 2, 3, 4, or 5 feet. Units shall be constructed of 24 gage steel. Maximum height of the unit’s plenum shall be 7-inches. Inlets shall have a minimum of 1-1/2-inch depth for duct connection. The standard finish shall be black on the face of the diffuser and pattern deflectors.
D. Diffuser shall be similar to Titus N-1-R diffuser.

2.13 WALL SUPPLY REGISTERS/GRILLES
A. Streamlined and individually adjustable curved blades to discharge air along face of grille with two-way deflection.
B. Fabricate 1-inch margin frame with countersunk screw, concealed mounting and gasket.
C. Fabricate of aluminum extrusions with factory clear anodized finish.
D. Provide multi-louvered equalizing grid where noted on Drawings.

2.14 WALL EXHAUST AND RETURN REGISTERS/GRILLES
A. Streamlined blades, depth of which exceeds ¾-inch spacing, with spring or other device to set blades, vertical or horizontal face as scheduled.
B. Fabricate one-inch margin frame with concealed mounting.
C. Fabricate of aluminum with 20 gage minimum frame, or aluminum extrusions, with factory baked enamel finish.

2.15 LOUVERS
A. Provide 6-inch deep louveres with blades on 45-degree slope with center baffle and return bend, heavy channel frame, birdscreen on interior side with 1/2-inch square mesh for exhaust and 3/4-inch for intake.
B. Fabricate of 12 gage extruded aluminum, welded assembly, with factory prime coat finish.
C. Furnish with exterior angle flange for installation.
D. Fabricate louver penthouses with mitered corners and reinforce with structural angles.
E. Pass 750 feet per minute free velocity with less than 0.10 inches of water pressure drop, based in accordance with AMCA 500. Water penetration less than 0.025 ounce of water per foot of free area at 900 feet per minute. Provide a minimum of 45 percent free area.

2.16 ROOF HOODS
A. Fabricate air inlet or exhaust hoods in accordance with SMACNA 1035, 1-inch classification Duct Construction Standards.
B. Fabricate of galvanized steel, minimum 16 gage base and 20 gage hood, or aluminum, minimum 16 gage base and 18 gage hood; suitably reinforced; with removable hood; birdscreen with 1/2-inch square mesh for exhaust and 3/4-inch for intake, and factory prime coat finish.
C. Roof curb shall be coordinated with Owner and roofing Contractor.
D. Hood outlet area shall be minimum two times the throat area.

2.17 GOOSENECKS
A. Fabricate in accordance with SMACNA 1035, 1-inch classification, of minimum 18 gage galvanized steel.
B. Roof curb shall be coordinated with Owner and roofing Contractor.
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 installation shall be in accordance with manufacturer's published recommendations.

C. Check location of air outlets and inlets and make necessary adjustments in position to conform to architectural features, reflected ceiling plans, symmetry, and lighting arrangement.

D. Install air outlets and inlets to ductwork with airtight connection.

E. Provide balancing dampers on duct take-off to diffusers, grilles and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly. The use of extractors or scoops at duct take-off to diffusers, grilles and registers is not allowed.

F. Paint ductwork visible behind air outlets and inlets matte black. Refer to Division 09.

G. Provide all specialties and frames for air distribution devices as required for proper installation in ceiling type as indicated on Architectural Drawings. Provide all cutting and patching of T-bars, gypsum board, and other ceiling systems as required for installation of air devices.

END OF SECTION
PART 1: GENERAL

1.01 SUMMARY
   A. Section includes design, performance criteria, refrigerants, controls, and installation requirements for air-cooled scroll compressor chillers.

1.02 REFERENCES
   A. Comply with applicable Standards/Codes of AHRI 550/590, ANSI/ASHRAE 15, ETL, cETL, NEC, and OSHA as adopted by the State.
   B. Units shall meet the efficiency standards of the current version of ASHRAE Standard 90.1, and FEMP standard 2012.

1.03 SUBMITTALS
   A. Submit shop drawings and product data in accordance with the specifications.
   B. Submittals shall include the following:
      1. Dimensioned plan and elevation view drawings, required clearances, and location of all field connections
      2. Summary of all auxiliary utility requirements such as electricity, water, etc. Summary shall indicate quality and quantity of each required utility.
      3. Single line schematic drawing of the field power hookup requirements, indicating all items that are furnished.
      4. Schematic diagram of control system indicating points for field interface/connection.
      5. Diagram shall fully delineate field and factory wiring.
      6. Installation and operating manuals.

1.04 QUALITY ASSURANCE
   A. Qualifications: Equipment manufacturer must specialize in the manufacture of the products specified and have five years experience with the type of equipment and refrigerant offered.
   B. Regulatory Requirements: Comply with the codes and standards specified.
   C. Chiller manufacturer plant must be ISO Registered.

1.05 DELIVERY AND HANDLING
   A. Chiller shall be delivered to the job site completely assembled and charged with refrigerant and oil by the manufacturer.
   B. Comply with the manufacturer's instructions for rigging and handling equipment.

1.06 WARRANTY
   A. Standard Warranty (Domestic): The refrigeration equipment manufacturer's guarantee shall be for a period of one year from date of equipment start-up but not more than 18 months from shipment. The guarantee shall provide for repair or replacement due to failure by material and workmanship that prove defective within the above period, excluding refrigerant.
   B. 1st Year Labor Warranty: None included
   C. Extended Compressor Warranty: Four (4) years extended compressor warranty, parts only.
   D. Extended Unit Warranty: None.
   E. Refrigerant Warranty: None.
F. Delay Warranty Start: None.

1.07 MAINTENANCE
A. Maintenance of the chillers shall be the responsibility of the owner and performed in accordance with the manufacturer’s instructions.

PART 2: PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS
A. Daikin Applied
B. (Approved Equal)

2.02 UNIT DESCRIPTION
A. Provide and install as shown on the plans factory-assembled, factory-charged air-cooled scroll compressor packaged chillers in the quantity specified. Each chiller shall consist of hermetic tandem scroll compressor sets (total four compressors), brazed plate evaporator, air-cooled condenser section, microprocessor-based control system and all components necessary for controlled unit operation.

2.03 DESIGN REQUIREMENTS
A. Flow Range: The chiller shall have the ability to support variable flow range down to 40% of nominal design (based on AHRI conditions).
B. Operating Range: The chiller shall have the ability to control leaving chilled fluid temperature from 15°F to 65°F.
C. General: Provide a complete scroll compressor packaged chiller as specified herein and as shown on the drawings. The unit shall be in accordance with the standards referenced in section 1.02 and any local codes in effect.
D. Performance: Refer to the schedule of performance on the drawings. The chiller shall be capable of stable operation to a minimum percentage of full load (without hot gas bypass) of 25%. Performance shall be in accordance with AHRI Standard 550/590.
E. Acoustics: Sound pressure levels for the unit shall not exceed the following specified levels. All manufacturers shall provide the necessary sound treatment (parts and labor) to meet these levels if required. Sound data shall be provided with the quotation. Test shall be in accordance with AHRI Standard 370.

<table>
<thead>
<tr>
<th>Sound Pressure (at 30 feet)</th>
<th>63 Hz</th>
<th>125 Hz</th>
<th>250 Hz</th>
<th>500 Hz</th>
<th>1000 Hz</th>
<th>2000 Hz</th>
<th>4000 Hz</th>
<th>8000 Hz</th>
<th>Overall dBA</th>
<th>75% Load dBA</th>
<th>50% Load dBA</th>
<th>25% Load dBA</th>
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| Sound Power |
|-------------|-----------------|-----------------|-----------------|
| 63 Hz       | 125 Hz          | 250 Hz          | 500 Hz          |
| 1000 Hz     | 2000 Hz         | 4000 Hz         | 8000 Hz         |
| Overall dBA | 75% Load dBA    | 50% Load dBA    | 25% Load dBA    |

2.04 CHILLER COMPONENTS
A. Compressor
1. The compressors shall be sealed hermetic, scroll type with crankcase oil heater and suction strainer. The compressor motor shall be refrigerant gas cooled, high torque, hermetic
induction type, two-pole, with inherent thermal protection on all three phases and shall be mounted on RIS vibration isolator pads. The compressors shall be equipped with an internal module providing compressor protection and communication capability.

B. Evaporator
1. The evaporator shall be a compact, high efficiency, dual circuit, brazed plate-to-plate type heat exchanger consisting of parallel stainless steel plates. The water-side working pressure shall be a minimum of 653 psig (4502 kPa). Vent and drain connections shall be provided in the inlet and outlet chilled water piping by the installing contractor. Evaporator shall be designed and constructed according to, and listed by, Underwriters Laboratories (UL).
2. The evaporator shall be protected with an external, electric resistance heater plate and insulated with 3/4” (19mm) thick closed-cell polyurethane insulation. This combination shall provide freeze protection down to -20°F (-29°C) ambient air temperature.
3. The water-side maximum design pressure shall be rated at a minimum of 653 psig (4502 kPa). Evaporators shall be designed and constructed according to, and listed by Underwriters Laboratories (UL).

C. Condenser
1. Condenser fans shall be propeller type arranged for vertical air discharge and individually driven by direct-drive fan motors. The fans shall be equipped with a heavy-gauge vinyl-coated fan guard. Fan motors shall be TEAO type with permanently lubricated ball bearings, inherent overload protection, three-phase, direct-drive, 1140 rpm. Each fan section shall be partitioned to avoid cross circulation.
2. Coil shall be microchannel design and shall have a series of flat tubes containing multiple, parallel flow microchannels 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. Coils shall consist of a two-pass arrangement. Each condenser coil shall be factory leak tested with high-pressure air under water. Coils shall withstand 1000+ hour acidified synthetic sea water fog (SWAAT) test (ASTM G85-02) at 120°F (49°C) with 0% fin loss and develop no leaks.

D. Refrigerant Circuit
1. Each of the two refrigerant circuits shall include a replaceable-core refrigerant filter-drier, sight glass with moisture indicator, liquid line solenoid valve (no exceptions), expansion valve, and insulated suction line.

E. Construction
1. Unit casing and all structural members and rails shall be fabricated of pre-painted or galvanized steel. Painted parts shall be able to meet ASTM B117, 1000-hour salt spray test.
2. Upper section of unit shall have protective and decorative louvers covering the coils and unit end and have painted steel wraps enclosing the coil end sections and piping.

F. Control System
1. A centrally located weatherproof control panel shall contain the field power connection points, control interlock terminals, and control system. Box shall be designed in accordance with NEMA 3R rating. Power and starting components shall include factory circuit breaker for fan motors and control circuit, individual contactors for each fan motor, solid-state compressor three-phase motor overload protection, inherent fan motor overload protection and two power blocks (one per circuit) for connection to remote, contractor supplied disconnect switches. Hinged access doors shall be lockable. Barrier panels or separate enclosures are required to protect against accidental contact with line voltage when accessing the control system.
2. Shall include optional single-point connection to a non-fused disconnect switch with through-the-door handle and compressor circuit breakers.

G. Unit Controller

1. An advanced DDC microprocessor unit controller with a 5-line by 22-character liquid crystal display provides the operating and protection functions. The controller shall take preemptive limiting action in case of high discharge pressure or low evaporator pressure. The controller shall contain the following features as a minimum:

2. The unit shall be protected in two ways: (1) by alarms that shut the unit down and require manual reset to restore unit operation and (2) by limit alarms that reduce unit operation in response to some out-of-limit condition. Shut down alarms shall activate an alarm signal.

3. Shutdown Alarms
   a. No evaporator water flow (auto-restart)
   b. Sensor failures
   c. Low evaporator pressure
   d. Evaporator freeze protection
   e. High condenser pressure
   f. Outside ambient temperature (auto-restart)
   g. Motor protection system
   h. Phase voltage protection (Optional)

4. Limit Alarms
   a. Condenser pressure stage down, unloads unit at high discharge pressures.
   b. Low ambient lockout, shuts off unit at low ambient temperatures.
   c. Low evaporator pressure hold, holds stage #1 until pressure rises.
   d. Low evaporator pressure unload, shuts off one compressor.

5. Unit Enable Section
   a. Enables unit operation from either local keypad, digital input, or BAS

6. Unit Mode Selection
   a. Selects standard cooling, ice, glycol, or test operation mode

7. Analog Inputs:
   a. Reset of leaving water temperature, 4-20 mA
   b. Current Limit

8. Digital Inputs
   a. Unit off switch
   b. Remote start/stop
   c. Flow switch
   d. Ice mode switch, converts operation and setpoints for ice production
   e. Motor protection

9. Digital Outputs
   a. Shutdown alarm; field wired, activates on an alarm condition, off when alarm is cleared
   b. Evaporator pump; field wired, starts pump when unit is set to start

10. Condenser fan control - The unit controller shall provide control of condenser fans based on compressor discharge pressure.

11. Building Automation System (BAS) Interface
   a. Factory mounted DDC controller(s) shall support operation on a BACnet®, Modbus® or LONMARK® network via one of the data link / physical layers listed below as specified by the successful Building Automation System (BAS) supplier.
b. BACnet MS/TP master (Clause 9)
c. BACnet IP, (Annex J)
d. BACnet ISO 8802-3, (Ethernet)
e. LONMARK FTT-10A. The unit controller shall be LONMARK® certified.
f. The information communicated between the BAS and the factory mounted unit controllers shall include the reading and writing of data to allow unit monitoring, control and alarm notification as specified in the unit sequence of operation and the unit points list.
g. For chillers communicating over a LONMARK network, the corresponding LONMARK eXternal Interface File (XIF) shall be provided with the chiller submittal data.
h. All communication from the chiller unit controller as specified in the points list shall be via standard BACnet objects. Proprietary BACnet objects shall not be allowed. BACnet communications shall conform to the BACnet protocol (ANSI/ASHRAE135-2001). A BACnet Protocol Implementation Conformance Statement (PICS) shall be provided along with the unit submittal.

2.05 OPTIONS AND ACCESSORIES
A. The following options are to be included:
   1. Low Ambient Control: Fan VFD allows unit operation from 32°F down to -10°F (-23.3 C).
   2. BAS interface module to provide interface with the BACnet MSTP protocol.
   3. The following accessories, if selected, are to be included:
      a. Spring vibration isolators for field installation
      b. Rubber-in-shear vibration isolators for field installation
      c. Factory-mounted thermal dispersion type flow switch
      d. Field-mounted, paddle type, chilled water flow switch field wired to the control panel
      e. Wye strainer, to be installed at the evaporator inlet and sized for the design flow rate, with perforation diameter of 0.063” with blowdown valve and Victaulic couplings (factory mounted or field installed)
      f. 115V GFI convenience outlet
B. Optional Factory-Installed Pump Package: None
   1. These pump package accessories, if selected, will also be included:
      a. Water pressure gauges on the pump suction and discharge
      b. Expansion tank with size increments from 4.4 to 90 gallons, field installed (small sizes can be factory mounted)
      c. Air separator with air vent, field installed
      d. Storage tanks, vertical, insulated, 150, 300, 600, 1000 gallon sizes with optional immersion heater, field installed.

PART 3: EXECUTION

3.01 INSTALLATION
   A. Install in strict accordance with manufacturer’s requirements, shop drawings, and contract documents.
   B. Adjust and level chiller in alignment on supports.
   C. Coordinate electrical installation with electrical contractor.
   D. Coordinate controls with control contractor.
E. Install a field-supplied or optional manufacturer-supplied strainer in the chilled water return line at the evaporator inlet that meets manufacturer perforation size specifications.

3.02 START-UP
   A. Provide testing and starting of machine, and instruct the Owner in its proper operation and maintenance.

END OF SECTION
SECTION 23 72 12

SEMI-CUSTOM PACKAGED ROOFTOP AIR CONDITIONERS

PART 1: GENERAL

1.01 Section Includes:
   A. Semi-custom Packaged Rooftop Air Conditioners

1.02 REFERENCES
   A. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
   C. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.
   D. AMCA 300 - Test Code for Sound Rating Air Moving Devices.
   E. AMCA 500 - Test Methods for Louver, Dampers, and Shutters.
   F. AHRI Standard 340/360- Unitary Large Equipment
   G. AHRI Standard 920 - DOAS
   I. ASTM B117 - Standard Practice for Operating Salt Spray Apparatus
   J. NEMA MG1 - Motors and Generators.
   K. NFPA 70 - National Electrical Code.
   L. UL 723 - Test for Surface Burning Characteristics of Building Materials.
   M. UL 900 - Test Performance of Air Filter Units.
   O. UL 94 - Test for Flammability of Plastic Materials for Parts in Devices and Appliances.
   S. ASHRAE 90.1 Energy Code.
   T. ASHRAE Std. 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems

1.03 SUBMITTALS
   A. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, electrical characteristics and connection requirements.
   B. Product Data:
      1. Provide literature that indicates dimensions, weights, capacities, ratings, and electrical characteristics and connection requirements.
      2. Provide data on filter media, filter performance, filter assembly, and filter frames.
      3. Provide computer generated fan curves with specified operating point clearly plotted.
   C. Manufacturers must clearly define any exceptions made to Plans and Specifications. Any deviations in layout, arrangement, or efficiency shall be submitted to the consulting engineer prior to bid date. Acceptance of deviation (s) from specifications shall be in the form of written approval from the consulting engineer.

Milam County Annex
Cameron, Texas 23 72 12 -1Semi-Custom Packaged Rooftop Air Conditioners
1.04 OPERATION AND MAINTENANCE DATA
   A. Maintenance Data: Provide instructions for installation, maintenance and service

1.05 QUALIFICATIONS
   A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience, who issues complete catalog data on total product.
   B. Certify Packaged Rooftop Performance in accordance with AHRI 340/360 Standards
   C. Product Energy Efficiency Compliant with ASHRAE 90.1 minimum energy efficiency requirements
   D. Startup must be done by trained personnel experienced with rooftop equipment.
   E. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters and remote controls are in place, bearings lubricated, and manufacturers’ installation instructions have been followed.

1.06 DELIVERY, STORAGE, HANDLING
   A. Deliver, store, protect and handle products to site.
   B. Handle carefully to avoid damage to components, enclosures, and finish
   C. Store in a clean, dry place to protect from weather and construction traffic.

PART 2: PRODUCTS

2.01 APPROVED MANUFACTURERS
   A. Basis of Design: Daikin Applied
   B. AAON: RL
   C. Trane: Intellipak
   D. Governaire
   E. Seasons 4
   F. Engineered Air
   G. Energy Labs

2.02 GENERAL DESCRIPTION
   A. Each unit shall be specifically designed for outdoor rooftop application and include a weatherproof cabinet. Units shall be of a modular design with factory installed access sections available to provide maximum design flexibility.
   B. Furnish unit configuration, layout, performance and electrical characteristics as shown on project plans and schedule.
   C. The unit shall undergo a complete factory run test prior to shipment. The factory test shall include final test of all fan assemblies, a refrigeration circuit runtest, a unit control system operations checkout, a unit refrigerant leak test, and a final unit inspection
   D. The complete unit shall be ETL listed.
   E. Unit shall be completely factory assembled and shipped in one piece.
   F. Unit to be shipped fully charged with R410A.
   G. All units shall have decals and tags to indicate caution areas and aid unit service. Unit nameplates shall be fixed to the main control panel door. Electrical wiring diagrams shall be
attached to the control panels. Installation, operating and maintenance bulletins and start-up forms shall be supplied with each unit.

H. Submittals must demonstrate that scheduled unit leaving air temperature (LAT) is met, that fan and motor heat temperature rise (TR) have been considered, and scheduled entering air temperature (EAT) equals mixed air temperature (MAT). Draw-thru cooling - Scheduled EAT equals cooling coil EAT and scheduled unit LAT equals cooling coil LAT plus TR.

2.03 CABINET

A. Unit construction for all walls, doors, ceiling and floor shall be double wall with a solid galvanized steel liner with a thermal break integral to the panel construction that provides a cleanable interior, prevents conductive heat transfer through the panel, and prevents exterior condensation on the panel.

B. Unit construction for all walls, doors, ceiling and floor shall be double wall with a solid stainless steel liner with a thermal break integral to the panel construction that provides a cleanable interior, prevents conductive heat transfer through the panel and prevents exterior condensation on the panel.

C. Foam Insulation shall provide a minimum thermal resistance R-value of 13.0.

D. Unit construction shall be designed to operate at total static pressures up to 8.0 inches w.g.

E. Provide quality unit construction with performance tested in accordance with ASHRAE Std 111 – cabinet air leakage shall not exceed leak class 6 (CL = 6), at +/- 6 in. w.c. casing pressure, where maximum cabinet leakage (cfm/100 ft^2 of casing surface area) = CL x P^0.65.

F. Provide quality unit construction with air leakage less than 0.5% of design airflow up to 5 in. w.c..

G. Provide quality unit construction with air leakage less than 1.0% of design airflow up to 8 in. w.c..

H. Exterior surfaces shall be constructed of pre-painted galvanized steel for aesthetics and long term durability. Paint finish to include a base primer with a high quality, polyester resin topcoat of a neutral beige color. Finished surface to withstand a minimum 1000-hour salt spray test in accordance with ASTM B117 standard for salt spray resistance.

I. Access shall be provided to filters, dampers, cooling coils, fan sections, compressors and electrical and controls components.

J. Access doors shall be provided for each critical maintenance section in order to provide user easy access to components. All access doors shall be mounted on full length stainless steel piano hinges and shall be secured by linkage and latch system that is operated by a single handle. The latch system shall feature a staggered engagement for ease of operation and a safety catch shall protect the user from injury in case a positive pressure door is opened while the fan is operating. Doors secured by multiple, mechanical fasteners are not acceptable.

K. The unit base frame shall be constructed of 13 gauge pre-painted steel to prevent base rail corrosion.

L. The unit base shall overhang the roof curb for positive water runoff and shall have a formed recess that seats on the roof curb gasket to provide a positive, weathertight seal. Lifting brackets shall be provided on the unit base with lifting holes to accept cable or chain hooks.

2.04 ACOUSTICS
A. Equipment sound performance shall meet the scheduled discharge and return sound power
B. Discharge Plenum sections shall be lined with a perforated acoustic liner to enhance sound attenuation.
C. Discharge and Return Plenum sections shall be lined with a perforated acoustic liner to enhance sound attenuation.

2.05 FANS
A. All Supply, Return and Exhaust Fans shall be configured in an array with a minimum number fans specified in the schedule for each unit.
B. Redundancy
   1. Size all fans for N-1 per the schedule
   2. Each supply, exhaust, and return fan motor shall have an independent integral inverter or a dedicated variable frequency drive per motor for redundancy.
C. All Fans shall be dynamically balanced as an assembly in planes as per DIN / ISO 21940 to balancing grade G 6.3 or better or provide 2” Spring isolation for each fan.
D. All fans shall be provided with totally enclosed maintenance-free ball bearings and permanent lubrication. Bearings shall be selected for a minimum life in excess of 350,000 hrs (L50) at selected operating point.
E. Fan airflow measuring
   1. All Supply Fans shall include a factory installed flow measuring station. Airflow needs to be readable through the unit controller and building automation system.
   2. All Supply and Exhaust Fans shall include a factory installed flow measuring station. Airflow needs to be readable through the unit controller and building automation system.
   3. All Supply and Return Fans shall include a factory installed flow measuring station. Airflow needs to be readable through the unit controller and building automation system.
F. ECM Supply Fans
   1. All fans shall be a single width, single inlet (SWSI) airfoil centrifugal fan. The fan wheel shall be Class II construction with aluminum fan blades that are continuously welded to the hub plate and end rim. The fan shall be a direct drive fan mounted to the motor shaft. Belts and sheaves are not acceptable due to the additional maintenance.
   2. The fan motor shall be a totally enclosed electrically commutated motor that is speed controlled by the rooftop unit controller. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase. Motors shall be premium efficiency.

2.06 ELECTRICAL
A. Unit wiring shall comply with NEC requirements and with all applicable UL standards. All electrical components shall be UL recognized where applicable. All wiring and electrical components provided with unit shall be number and color coded and labeled according to the electrical diagram provided for easy identification.
B. The unit shall be provided with a factory wired weatherproof control panel. Unit shall have a power terminal block for main power connection. A terminal board shall be provided for low voltage control wiring. Branch circuit short circuit protection, 115 volt control circuit transformer and fuse, system switches, and a high temperature sensor. Each compressor and condenser
fan motor shall be furnished with contactors and inherent thermal overload protection. Supply and return fan motors shall have contactors and external overload protection. Knockouts shall be provided in the of the main control panels for field wiring entrance.

C. All 115-600 volt internal and external wiring between control boxes and components shall be protected from damage by dedicated electrical raceways.

D. The receptacle shall be powered by a field supplied 115V source.

E. Single non-fused disconnect switch shall be provided for connecting electrical power at the unit. Disconnect switches shall be mounted internal to the control panel and operated by an externally mounted handle.

F. Unit SCCR Rating to be 10 kAIC minimum

G. Unit shall be provided with phase, voltage and brown out protection which shuts down all motors in the unit if the electrical phases are more than 10% out of balance on voltage or on phase reversals.

H. Unit shall be provided with a safety shutdown terminal for installation of field emergency input.

I. All electrical options shall have a +/- 10 percent voltage utilization range to protect against voltage variation.

2.07 SAFETY OPTIONS

A. Unit shall be provided with a safety shutdown terminal for installation of field emergency input.

2.08 COOLING COIL

A. The cooling coil section shall be installed in a draw through configuration, upstream of the supply air fan. The coil section shall be complete with factory piped cooling coil and sloped drain pan.

B. Direct expansion (DX) cooling coils shall be fabricated of seamless 1/2" diameter high efficiency copper tubing that is mechanically expanded into high efficiency aluminum plate fins. Coils shall be a multi-row, staggered tube design with a minimum of 4 rows. All units shall have two independent refrigerant circuits and shall use an interlaced coil circuiting that keeps the full coil face active at all load conditions.

C. Each refrigeration circuit shall be equipped with a thermostatic expansion valve for control refrigerant flow control.

D. The refrigerant suction lines shall be fully insulated from the expansion valves to the compressors.

E. The distributor tubes shall be sleeved or coated to provide longevity and protection from leaks.

F. All coils shall be factory leak tested with high pressure air under water.

G. The drain pan shall be stainless steel and designed to comply with ASHRAE- 62.1 double sloped requirements drain pan shall be provided with the cooling coil. The drain pan shall extend beyond the leaving side of the coil and underneath the cooling coil connections. The drain pan shall have a minimum slope of 1/8" per foot to provide positive draining. The drain pan shall be connected to a threaded drain connection extending through the unit base. Units with stacked cooling coils shall be provided with a secondary drain pan piped to the primary drain pan.
H. Insulation under the drain pan should be a closed cell structure to prevent moisture from wicking under the drain pan. Fiberglass is not allowed.

2.09 MODULATING HOT GAS AND LIQUID REHEAT
A. Hot Gas Reheat: Unit shall be equipped with a fully modulating hot gas reheat coil with hot gas coming from the unit condenser.
   1. Hot gas reheat coil shall be a Microchannel design. The aluminum tube shall be a microchannel design with high efficiency aluminum fins. Fins shall be brazed to the tubing for a direct bond. The capacity of the reheat coil shall allow for a 20°F temperature rise at all operating conditions.
   2. The modulating hot gas reheat systems shall allow for independent control of the cooling coil leaving air temperature and the reheat coil leaving air temperature. The cooling coil and reheat coil leaving air temperature set points shall be adjustable through the unit controller. During the dehumidification cycle the unit shall be capable of 100% of the cooling capacity. The hot gas reheat coil shall provide discharge temperature control within +/- 2°F.
   3. Each coil shall be factory leak tested with high-pressure air under water.
B. Dehumidification operation with Hot gas reheat shall use direct air temperature feedback from the leaving face of the evaporator coil for controlling the compressor cooling capacity and the reheat will be fully modulate to maintain the leaving/supply air temperature set point. The leaving/supply air temperature set point can be reset based on outside, space, and return temperature or humidity.

2.010 GAS HEAT
A. The gas furnace design shall be factory installed downstream of the supply air fan in the heat section.
B. The heat exchanger shall include a 439 grade Stainless steel. Aluminized steel heat exchangers are not acceptable. The heat exchanger design shall collect condensate in a collection point and have a condensate drain.
C. The furnace will be supplied with a modulating induced draft burner. The burner shall be controlled for low fire start. The burner shall be capable of continuous modulation between 10% and 100% (10:1 control) of rated capacity.
D. The burner shall be specifically designed to burn natural gas and shall include a micro-processor based flame safeguard control, combustion air proving switch, pre-purge timer and spark ignition. Status and alarm codes are available at the unit controller via a network connection and are available for BAS integration.
E. I. Provide with a 15 year gas heat exchanger warranty

2.011 DRAW THROUGH FILTERS
A. All units shall be provided with clogged filter switches and alarm enunciation
B. Unit shall be provided with a draw-through filter section.
C. The filter rack shall be designed to accept a 2” pleated filter. The manufacturer shall ship the rooftop unit with 2” MERV 8 filters. The contractor shall furnish and install, at building occupancy, the final set of filters per the contract documents

2.012 OUTDOOR/RETURN AIR SECTION
A. Unit shall be provided with a Metal Mesh pre-filter in the outdoor air hood/section to prefilter large particulate to prevent early filter clogging.
B. Unit shall be provided with a 100% Outside Air damper. The outdoor air hood shall be factory installed and constructed from galvanized steel finished with the same durable paint finish as the main unit. The hood shall include moisture eliminator filters to drain water away from the entering air stream. The outside and return air dampers shall be sized to handle 100% of the supply air volume. The dampers shall be parallel blade design. Damper blades shall be gasketed with side seals to provide an air leakage rate of 1.5 cfm / square foot of damper area at 1” differential pressure in according with testing defined in AMCA 500. Control of the dampers shall be by a factory installed direct coupled actuator.

2.013 DISCHARGE AND RETURN PLENUM OPTIONS
A. A supply air discharge plenum shall be provided. The plenum section connection shall have a bottom, right, left, or top discharge opening consult the schedule and drawings for the final orientation.

2.014 CONDENSING SECTION
A. All Units shall provide the Energy Efficiency specified EER and IEER per the schedule equipment or higher.
B. Condenser fans shall be direct drive, axial type designed for low tip speed and vertical air discharge. Fan blades shall be constructed of steel and riveted to a steel center hub. Condenser fan motors shall be heavy-duty, inherently protected, three-phase, non-reversing type with permanently lubricated ball bearing and integral rain shield.
C. Condenser coils shall be an all aluminum design, and mounted on polymer brackets, to minimize di-electric corrosion. The aluminum tube shall be a micro channel design with high efficiency aluminum fins. Fins shall be brazed to the tubing for a direct bond. Each condenser coil shall be factory leak tested with high-pressure air under water.
D. Condenser coils shall be protected from incidental contact to coil fins by a coil guard. Coil guard shall be constructed of cross wire welded steel with PVC coating
E. Head Pressure Control
   1. Units shall have at least one condenser fan controlled to maintain positive head pressure. SpeedTrol™ condenser fan speed control shall be added to the last fan off on each refrigeration circuit to provide cooling operation to ambient temperatures down to 0° F. Fan speed control shall be field adjustable.
F. Each unit shall have multiple, heavy-duty scroll compressors. Each compressor shall be complete with gauge ports, crankcase heater, sight-glass, anti-slug protection, motor overload protection and a time delay to prevent short cycling and simultaneous starting of compressors following a power failure. Compressors shall be isolated with resilient rubber isolators to decrease noise transmission
G. Each unit shall have two independent refrigeration circuits for redundancy. Each circuit shall be complete with a low pressure control, filter-drier, liquid moisture indicator/sight-glass, thermal expansion valve, and a manual reset high pressure safety switch. The thermal expansion valve shall be capable of modulation from 100% to 25% of its rated capacity. Sight-glasses shall be accessible for viewing without disrupting unit operation. Each circuit shall be dehydrated and factory charged with Refrigerant 410A and oil.
H. Each unit shall have at least 4 compressor stages of cooling capacity control for better part load control as required by ASHRAE 90.1-2013.

2.015 CONTROLS
A. Each unit shall be equipped with a complete MicroTech® microprocessor based control system. The unit control system shall include all required temperature and pressure sensors, input/output boards, main microprocessor and operator interface. All boards shall be individually replaceable for ease of service. All microprocessors, boards, and sensors shall be factory mounted, wired and tested.
B. The microprocessor shall be a stand-alone DDC controller not dependent on communications with any on-site or remote PC or master control panel. The microprocessor shall maintain existing set points and operate standalone if the unit loses either direct connect or network communications. The microprocessor memory shall be protected from voltage fluctuations as well as any extended power failures. All factory and user set schedules and control points shall be maintained in nonvolatile memory. No settings shall be lost, even during extended power shutdowns.
C. The main microprocessor shall support an RS-232 direct connection to a product service tool or a modem. A communications module shall be provided for direct communication into the BAS network.
D. All digital inputs and outputs shall be protected against damage from transients or wrong voltages. Each digital input and digital output shall be equipped with an LED for ease of service. All field wiring shall be terminated at a separate, clearly marked terminal strip.
E. The microprocessor shall have a built-in time schedule. The schedule shall be programmable from the unit keypad interface. The schedule shall be maintained in nonvolatile memory to insure that it is not lost during a power failure. There shall be one start/stop per day and a separate holiday schedule. The controller shall accept up to sixteen holidays each with up to a 5-day duration. Each unit shall also have the ability to accept a time schedule via BAS network communications.
F. If the unit is to be programmed with a night setback or setup function, an optional space sensor shall be provided. Space sensors shall be available to support field selectable features. Sensor options shall include Zone sensor with tenant override switch, or Zone sensor with tenant override switch and heating/cooling set point adjustment.

2.016 WARRANTY
A. The manufacturer shall provide 12 month parts only warranty. Defective parts will be repaired or replaced during the warranty period at no charge. The warranty period shall commence at start up, or 6 months after shipment, whichever occurs first.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary
      Conditions and Division 01 & Division 20 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. Perform all Work required to provide and install modular air handling units, including factory
      installed fans, dampers, coils, motors, and any specialty equipment as indicated in the
      Contract Documents with supplementary items necessary for proper installation.
   B. This section includes factory-assembled modular air handling unit (AHU) that includes but is
      not limited to the following:
      1. Casing.
      2. Fans.
      5. Filter sections.
      6. Additional sections.
      7. AHU dampers.
      8. Accessories.

1.3 REFERENCE STANDARDS
   A. The latest published edition of a reference shall be applicable to this Project unless identified
      by a specific edition date.
   B. All reference amendments adopted prior to the effective date of this Contract shall be
      applicable to this Project.
   C. All materials, installation and workmanship shall comply with the applicable requirements and
      standards addressed within the following references:
      1. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
      2. AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
      5. AMCA 300 - Test Code for Sound Rating Air Moving Devices.
      7. AMCA 500 - Test Methods for Louver, Dampers, and Shutters.
      8. ARI 260 - Sound Rating of Ducted Air Moving and Conditioning Equipment
     10. ARI 430 - Central-Station Air-Handling Units.
     11. ARI 610 - Central System Humidifiers.
     12. NEMA MG1 - Motors and Generators.
     15. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
     16. UL 900 - Test Performance of Air Filter Units.
        Residential Buildings.

1.4 QUALITY ASSURANCE
A. Performance Ratings: Conform to ARI Standards; bear ARI 430 certified rating seal. If unit is not ARI 430 rated, unit shall be tested in accordance with the standards to establish acceptability.

B. Sound Ratings: Test air handling unit in accordance with AMCA 300 (ASHRAE 68) and ARI 260 Guidelines.

C. Air Coils: Certify capacities, pressure drops, and selection procedures in accordance with ARI 410.

D. Manufacturer: Regularly engaged in production of components that issues complete catalog data on total product and has at least two (2) years of manufacturing experience for the product specified.

E. Base performance on sea level conditions, unless otherwise scheduled.

F. Provide complete unit including components designed to operate within range of 35 degrees F to 135 degrees F ambient temperature, 20 to 70 percent relative humidity in conditioned mechanical rooms and 100 percent relative humidity in unconditioned mechanical rooms.

G. The Contract Documents are based on the equipment scheduled. Contractor is advised that the use of equipment other than that scheduled may directly affect and require coordination with (but not limited to) the following items:

1. Mechanical room sizes and building structural conditions, with required clearances.
2. Electrical starter/disconnect switch, wire and conduit sizes; electrical clearances as per NEC.
3. Ductwork and piping layouts and return air opening sizes and locations.
4. Plumbing floor drain location.

H. Units shall fit into the space available with adequate clearance for service as determined by the Engineer. Submitted units, which do not meet these criteria, shall be rejected. Do not assume that all of the manufacturers listed as acceptable manufacturers will provide a unit that will fit in the space allocated. Selection of acceptable manufacturers is not based on whether the manufacturer's standard stock unit will fit into every space allocated. A custom or semi-custom air-handling unit may be required to meet project space and performance requirements.

1.5 SUBMITTALS

A. Product Data and Record Documents:

1. Provide literature that indicates dimensions, weights, capacities, ratings, fan performance, gages and finishes of materials, electrical characteristics and connection requirements. Refer to detailed listing of submittal data in this Section.
2. Provide data of filter media, filter performance data, filter assembly, and filter frames as tested and certified per ASHRAE standards and NFPA 90 flame spread and smoke rating standards.
3. Provide fan curves with specified operating point clearly plotted, as tested and certified per AMCA standards. Ratings to include system effects. Bare fan ratings will not satisfy this requirement, but shall be submitted for comparison purposes. All fan data shall be generated from specified testing. The fan shall compare favorably with the scheduled data listed in the Drawings. Where two fans are operated in parallel, provide Hagen's Line plots on fan curves to prove that fans will not be operating in the unstable region.
4. Submit sound power level data for both fan outlet and casing radiation at rated capacity, as tested and certified per AMCA and ARI 260 standards. All fan data shall be generated from specified testing. The fan shall compare favorably with the scheduled data listed in the construction Drawings. The selected unit will not exceed the scheduled sound power data.
5. Unit manufacturer shall submit full sound performance data to the Project sound consultant for evaluation. Unit shall be finally configured so as not to exceed sound levels as scheduled on Contract Documents.
6. Provide data on all coils as tested and certified per ARI standards.
7. Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.
8. All materials shall have NFPA-90 rating of 25/50 or better.
9. Submit cataloged coil moisture carryover curves. The curves shall be plotted at the coil...
operating point and shall show the maximum coil moisture carryover limits.

10. Base Rail Height Calculations: Provide calculations for required base rail heights to allow for proper condensate trapping per condensate drain details.

B. Operation and Maintenance Data:
   1. Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.
   2. Provide Operating and Maintenance (O&M) Manuals for air handling units. In addition to a full set of manuals with closeout documentation, each unit shall ship with its own manual permanently mounted inside the unit casing fan section in a watertight enclosure.
   3. Permanently mount condensate trapping calculation instructions within the unit O&M Manual that illustrates the unit casing at the condensate drain connection.
   4. Manufacturer’s Instructions: Provide Start-up information and maintenance required prior to Start-up.

1.6 DELIVERY, STORAGE AND HANDLING

   A. Deliver, store, protect and handle products to the Project Site under provisions of Division 01 and Division 20.
   B. Accept products on Site in factory-fabricated protective containers or covered to protect from weather and construction debris, with factory-installed shipping skids and lifting lugs. Inspect for damage and make any necessary repairs at no expense to the Owner.
   C. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish. Replace damaged equipment.
   D. Protect openings in casing and seal them with plastic wrap to keep dirt and debris, also protect coils from entry of dirt and debris with pipe caps or plugs.

1.7 EXTRA MATERIALS

   A. Provide [one] [two] additional sets of specified fan belts, sheaves, and filters for each unit, packaged for storage after each unit has been tested and operated for final acceptance by Owner. Tag products to identify associated unit.

1.8 SCHEDULES ON DRAWINGS

   A. In general, all capacities of equipment, and motor and starter characteristics are shown in schedules on the Drawings. Reference shall be made to the schedules for such information. The capacities shown are minimum capacities. Variations in the capacities of the scheduled equipment supplied under this Contract will be permitted only with the written direction of the Owner.
   B. Insofar as is possible, all items of the same type (i.e., coils, fans, etc.) shall be by the same manufacturer.
   C. Where installation instructions are not included in the Contract Documents, the manufacturer’s instructions shall be followed.
   D. Motor and wheel diameters shown on the AHU schedules are the minimum. If a larger wheel diameter or horsepower is required, it shall be so quoted and noted on evaluation forms in this section.

PART 2 - PRODUCTS

2.1 GENERAL

   A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
   B. All air handling units shall be a draw-through configuration type unless noted otherwise (as scheduled) double-wall air-handling unit meeting or exceeding the performance requirements and capacities as shown. All internal components specified shall be factory furnished and installed. Units shall be post and panel bolted modular and sectionalized construction for ease of disassembly and reassembly for maintenance, cleaning, and inspection in accordance with
the most recent edition of ASHRAE Standard 62. At a minimum, sectionalized modules shall consist of fan, coils, access and filter sections. All internal components specified shall be factory furnished and installed as applicable.

C. Provide all necessary and required tags and decals to aid in the service or indicate caution areas.

D. Ship unit in one piece whenever possible. If shipping splits are required for installation, the unit must be assembled, with all required gasketing, under direct supervision of factory trained and employed personnel from the unit manufacturer. Written approval from the equipment manufacturer certifying the installing mechanical Contractor as qualified for assembly is acceptable as an alternative for supervision. The equipment manufacturer, however, shall not relinquish its responsibility for the correct assembly of units.

E. Provide complete unit with segments as indicated on Drawings and in this Specification or as required for unit operation in accordance with performance requirements specified herein. Refer to filter Specification Section for filter requirements.

2.2 MANUFACTURERS

A. Trane.
B. York.
C. Carrier.
D. Daikin Applied.

2.3 UNIT CASING

A. Base Rail:
1. Minimum 12 gage, continuous full-length galvanized structural steel unit perimeter base frame rail to form a unitized assembly.
2. Base rail height shall be sufficient to allow proper condensate trapping. Lowest coil condensate drain connection shall be a minimum of 6 inches from the bottom of the rail.

B. Casing Walls:
1. Provide post and panel construction with unit casing walls of minimum 16 gage or equivalent exterior and 20 gage solid interior G90 galvanized steel panels for all sections.
2. Casing walls shall be non-load bearing and must allow air handling unit interior cleaning of microbial growth and other debris per the latest ASHRAE Standard 62.
3. Provide gaskets between section and access panels. All panels shall be sealed to create an airtight unit. Assemble sections with gaskets and bolts. Sheet metal screws are not acceptable as use as panel or frame fasteners. Reinforce and brace unit housing with steel angle framework to provide rigidity and prevent pulsations. Provide thermal breaks between inner and outer walls and posts to prevent moisture condensation on the exterior of the unit. Any condensation on the units shall be corrected to the satisfaction of the Owner and at no expense to the Owner.
4. The manufacturer shall certify that the unit casing leakage shall not exceed 0.5 cfm per square foot of cabinet area at 5 inches positive or negative static pressure. Panel deflection shall not exceed L/240 ratio at a maximum 5 inches of positive or negative static pressure. Deflection shall be measured at the midpoint of L, which is the panel height.

C. Insulation:
1. Provide factory insulated casing sections with expanded foam or non-compressed fiberglass (three pound per cubic foot density) insulation with a minimum R-value of 12.
2. Insulation and adhesive shall meet requirements of NFPA 90A. Insulation shall meet the erosion requirements of UL181.
3. No insulation surfaces shall be exposed to the airstream. Install insulation in manner to not be disturbed when panels are removed.

D. Access/Inspection Doors:
1. Provide galvanized steel double wall inspection doors of the same thickness and construction as the casing panels. Provide full-perimeter flush mounted and gasketed doors with a latch and handle assembly.
2. Provide heavy-duty cadmium plated steel or stainless steel hinges.
3. Provide access doors on fan and filter section of the unit and additional locations where specified on the Drawings.
4. Hinges shall be interchangeable with the door handle hardware to allow for alternating door swing in the field to minimize access interference. Door handle hardware shall visually indicate locking position of door latch external to the module. Door latching hardware shall not penetrate the access doors.
5. All access doors shall open against air pressure, unless approved by the Owner in writing.
6. Where scheduled, dual thermal pane windows shall be provided in all access doors. Minimum window dimensions shall be 8-inch x 8-inch.

E. Coil Casings:
1. Construct coil section so coils can be removed without affecting structural integrity of casing. Completely enclose connections, coil headers, and return bends.
2. Provide Type 304 stainless steel coil frame with intermediate casing supports as required.

F. Drain Pans:
1. Provide drain pans constructed of Type 304 stainless steel on airside with insulation between pan and casing. The drain pan insulation shall be closed cell foam injected water impervious rigid type, minimum R-value of 8, and shall occupy all voids and areas between the drain pan and outer wall to prevent the occurrence of trapped water, condensation, and microbial growth. Fiberglass drain pan insulation is not acceptable.
2. Any condensation from the drain pan or drain connection shall be corrected by unit manufacturer to the satisfaction of the Owner, and at no expense to the Owner.
3. Drain pan shall have raised lips, welded corners, and stainless steel threaded pipe drain connection to match the drain pan and prevent dielectric corrosion.
4. Drain pan connections that penetrate the base rail must be a minimum of 6 inches in height as described above, and shall come factory insulated in a permanent aluminum jacket to prevent condensation of moisture under the unit.
5. Drain pans must be triple sloped for complete drainage and in compliance with ASHRAE Standard 62. Unit condensate drain inlet shall be centered on bottom of drain pan to allow complete drainage. Provide drain pans extending under complete cooling coil section and extending 24 inches minimum downstream of cooling coil. Provide intermediate drain pans that extend minimum of 6 inches from the coil face with downspouts to bottom drain pan for cooling coil banks more than one coil high. Intermediate drain pans shall be stainless steel to match the main drain pan.

G. Blow-Through Units:
1. Provide galvanized internal wall in coil section opposite cooling coil.
2. Provide with perforated galvanized steel diffuser plate between the fan discharge and the coil section to ensure equal velocity profile across the coils.
3. All triple deck multi-zone units must also have a perforated equalizing plate in the neutral deck.

H. Provide a permanent factory-installed sealable port on each section of unit to allow for testing and balancing of system, except where port would be blocked by filters or coils.

2.4 FANS
A. Fan Sections:
1. Provide fan sections with, airfoil (AF), backward inclined (BI), or single-width single-inlet (SWSI) plug (PF) fans, minimum class II, as scheduled. The fan wheel shall have a minimum number of 9 blades.
2. Higher RPM AF and BI fan casings shall come equipped with additional heavy duty rectangular angle framework for increased strength and stability.
3. Fan and unit performance shall be rated and certified in accordance with ARI 430, AMCA300 and ARI 260 as specified elsewhere herein.
4. Fan wheels shall be constructed aluminum or stainless steel, keyed to the fan shaft, and shall be statically and dynamically balanced at the factory as a complete fan assembly regardless of duty. 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.
5. Forward factory balancing test report upon request of Engineer.

B. Mount motor drive and fan on integral framework, internally isolated from the casing with factory installed 1-inch deflection spring vibration isolators on units with 8 square feet of coil area or less, and 2-inch deflection on units with coils greater than 8 square feet in area. The fan, drive, and base assembly shall be factory point load tested and balanced with corner isolators selected accordingly for increased stability and to minimize fan assembly noise and vibration and extend bearing life.

C. Provide internal flexible connection on discharge of fan to isolate fan from casing. Additionally, provide spring loaded fan-shroud-to-casing thrust restraints for all airfoil and backward inclined fans, and on all units with coil face areas greater than 30 square feet.

2.5 BEARINGS AND DRIVES
A. Bearings:
1. Provide self-aligning grease lubricated pillow-block ball bearings. Bearings shall be lubricated at the factory and equipped with means for lubrication on the outside of the bearing housing.
2. Bearings shall be designed for an average life (L10) of at least 200,000 hours at the maximum horsepower and operating speed for the classification.
3. Opposite drive side fan bearings shall be sized appropriately to prevent premature wear and bearing skating from uneven loads on bearings to extend bearing life.

B. Motors and Controllers: Motors shall be in compliance with motors and controllers Specification Section.

C. Shafts:
1. Solid hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.
2. Shafts shall not pass through first critical speed as unit comes up to rated RPM and shall be balanced as part of the fan assembly as described above.

D. V-Belt Drive:
1. Cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed.
2. Variable and adjustable pitch sheaves for motors 15 horsepower and under. Select variable and adjustable pitch sheaves so required RPM is obtained with sheaves set at mid-position.
3. Provide fixed pitch sheaves for motors equipped with variable speed drives. Provide belts and drive rated for minimum one and one-half times nameplate rating of motor.

E. Direct Drive: Units with scheduled plug fans and variable frequency drives shall be direct drive.

2.6 WATER COILS
A. Provide counterflow chilled water and hot water coils as scheduled. Provide vertical or horizontal coil connection entry to unit casing as scheduled or shown on the Drawings to maximize maintenance accessibility and minimize coil piping and valve interference.

B. Slide coils into casing through removable end panel with blank off sheets and sealing collars at connection penetrations.

C. Rate coils in accordance with ARI certified data. Select coil to provide capacity in accordance with water flow and temperatures scheduled on Drawings with maximum water pressure drop through coil as scheduled and a maximum velocity in tubes of 8 feet per second. Provide coil with maximum face velocity of 375 fpm for constant volume applications and 400 fpm for variable volume applications or as indicated otherwise on Drawings.

D. Provide 1/2-inch or 5/8-inch outside diameter copper tube coils, staggered in direction of airflow, with aluminum plate fins, maximum 6-row and nine (9) fins per inch with copper headers. Steel pipe water connections shall be welded to copper headers with silica-bronze weld to prevent dielectric corrosion of dissimilar metals and extend the life of the coils. If additional rows are required pipe coils in series and provide access section between coils.

E. Provide coils with plate fin wall thickness of 0.006-inch and tubes of minimum wall thickness of 0.035-inch for 5/8-inch coils and 0.020 for 1/2-inch coils. Connect tubes to header that
provides equal flow to all tubes and provide single point connections for supply and return piping per coil. Factory test all coils to 325 psig and forward coil test reports to the Engineer with submittal documentation.

2.7 FILTER SECTIONS
A. General:
1. Air shall not be allowed to bypass around filters. Provision shall be made to positively lock filters in place to prevent shifting.
2. Provide applicable filter and final filter sections as scheduled or shown on the Drawings.
3. Provide specified filters for use during construction and replace with new filters prior to testing and balancing. Replace filters as needed between testing and balancing, functional performance tests and final acceptance by Owner.
4. Some units may have multiple filter sections and multiple filter types. Some filter section types shown here may not be used on the Project.
B. Angle Filters: Low-velocity angular filter frames with integral, side-access, galvanized steel or extruded aluminum filter frames suitable for 2-inch media. Combine with mixing box where scheduled on Drawings.
C. Flat Filters: Flat (perpendicular to airflow direction) filter frames with integral, side-access, galvanized steel or extruded aluminum filter frames suitable for 2-inch or 4-inch media (as scheduled).
D. Open Return Filters: Flat (perpendicular to airflow direction) filter frames with integral, front-access, galvanized steel or extruded aluminum filter frames suitable for 2-inch or 4-inch media (as scheduled).
E. Cartridge (Rigid) Filters: Flat (perpendicular to airflow direction) filter frames with integral, front or side-access, galvanized steel or extruded aluminum filter frames, with neoprene gasketing on the leaving air side of the filter, suitable for a 2-inch pre-filter media and a 12-inch rigid filter media.
F. HEPA Filters: Flat (perpendicular to airflow direction) filter frames with integral, front-load access, galvanized steel or extruded aluminum filter frames, with leak-free neoprene gasketing on the leaving air side of the filter, suitable for a 24-inch high efficiency HEPA filter media.
G. Filter Gauges: Magnahelic differential pressure gauges shall be installed and mounted on drive side of unit to measure the pressure drop across the filter sections as indicated on the Drawings.
H. Refer to filter specification section for filter media.
I. Refer to Drawings for type of filter media scheduled per unit.

2.8 ADDITIONAL SECTIONS
A. All additional sections of the unit, including blank sections and turning sections required for proper unit operation, maintenance, and configuration, shall meet the unit casing requirements listed in this Section. Refer to Drawings for additional sections required.
B. Mixing Box Section: Where specified or shown on the Drawings, provide with factory-mounted interconnected outside and return air dampers mounted in a galvanized frame. Mixing box section shall be configured to allow access to front-load filter frame.
C. Economizer Section: Where specified or shown on the Drawings, provide an economizer section complete with three sets of dampers to control return, exhaust and outside air.
D. Diffuser Section: Provide with perforated diffuser plate that assures an even distribution of airflow across the entire unit internal area. Units are specified with final filters or blow-through coils, shall have a diffuser section immediately downstream of the fan.
E. Access Section(s): Provide access sections with door where specified or shown on Drawings. Floors of access section must be heavy-duty to accommodate maintenance personnel/equipment. Door size shall be at least 18 inches wide and full panel height up to 72-inch tall units.
F. Discharge Plenum: Provide a discharge plenum as the last section in the direction of airflow where specified or shown on the Drawings. The plenum shall be suitable for single or multiple discharges as indicated on the Drawings. Positive pressure plenum access doors must swing
inward against air pressure to prevent personnel injury.

G. Multi-Zone Section:
1. Provide a multi-zone section where specified or indicated on the Drawings.
2. The multi-zone section shall have factory installed, internally sealed hot and cold decks, and a neutral deck where a triple-deck multi-zone is specified.
3. A balance plate shall be provided to equate the pressures.
4. Factory hot, cold, and neutral deck dampers shall be provided. Dampers shall be removable from the unit and each other. Dampers shall be on a single shaft.

2.9 AIR HANDLING UNIT DAMPERS
A. Provide ultra-low leakage opposed blade dampers furnished by the unit manufacturer with galvanized steel double-skin airfoil blades. Blades shall have vinyl or rubber blade edge seals and compressible jamb seals. Blades shall rotate on stainless steel sleeve bearings. Dampers must be constructed and tested so as to have a leakage rate not to exceed 5 cfm per square foot at 1 w.g. differential pressure.

B. Multi-Zone Dampers:
1. Factory-mounted in galvanized steel frame.
2. Damper blades shall be constructed of galvanized steel double-skin airfoil or stamped steel blades. Blades shall have vinyl or rubber blade edge seals and compressible jamb seals. Blades shall rotate on stainless steel sleeve bearings.
3. Linkage shall have external connections. Number of zones shall be as shown on the Drawings. Multi-zone dampers must be constructed and tested so as to have a leakage rate not to exceed 11 cfm per square foot at 1 w.g. differential pressure.

2.10 ELECTRICAL PROVISIONS
A. Fan motors shall be factory mounted and wired to an external disconnect switch within sight of the motor access door. Fan motors shall be interlocked with fan access door to shut down fan when door is opened.

B. Disconnect switches and starters shall be mounted independent of the unit to allow for maintenance access and access to AHU components. Locate disconnect switches within close proximity and sight of the electrical component. Interlock fan motor starters with a position limit switch located at the fan section access door. The limit switch shall de-energize the fan motor or other electrical components when the access door is opened.

C. Provide moisture-proof, two-lamp linear fluorescent light fixtures with electronic ballasts manufactured by Lithonia DM 232 M Volt, or equivalent, and the light fixtures in each air handling unit section shall be switched. Wire lights to external 120V, 20A power connections for connection by Division 26. Fixtures and lamps shall comply with Division 26 requirements.

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 installation shall be in accordance with manufacturer’s published recommendations.

C. Make joints and connections fully gasketed and air-tight.

D. Install filters.

E. Install units on equipment supports as described in vibration isolation specification section.

F. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings have been lubricated, and fan has been test run under Owner representatives’ observation.

G. Casing Integrity:
1. No field penetrations of the air handler casing are permitted.
2. All penetrations required to accomplish testing, balancing, to provide power to internal devices, and to provide control signals to and from control devices shall be made and sealed at the factory.
3. Coordinate with the manufacturer to allow for all necessary penetrations to provide a
complete, functioning, and maintainable system. Internal control devices shall be shipped to the air handler manufacturer for installation at no cost to the Owner.

3.2 AIR HANDLING UNIT SUBMITTAL DATA

A. The information for each item listed below must be furnished as part of the shop drawing submittals. Additional data may be submitted on separate sheets. Submit the requested data on the forms provided. Provide data for the air-handling units noted on the Drawings.

B. General Data:
   1. Air Handling Unit Manufacturer
   2. Maximum Exterior Dimensions (Assembled)
      a. Length (feet)
      b. Width (feet)
      c. Height (feet)
      d. (Attach general arrangement drawing.)
   3. Operating weight (pounds)

C. Filters:
   1. Manufacturer
   2. Type
   3. Efficiency (percent)
   4. Quantity
   5. Pressure Drop
      a. Clean
      b. Dirty
   6. (Attach manufacturer's literature.)

D. Final Filters:
   1. Manufacturer
   2. Type
   3. Efficiency (percent)
   4. Quantity
   5. Pressure Drop
      a. Clean
      b. Dirty
   6. (Attach manufacturer's literature.)

E. Preheat Coil:
   1. Manufacturer
   2. Air Flow (cfm)
   3. Face Velocity
   4. Air Entering Temperature (degrees F)
   5. Air Leaving Temperature (degrees F)
   6. Fins per inch (9 maximum)
   7. Rows (2 maximum)
   8. Minimum Capacity (Btuh)
   9. Rated Capacity (Btuh)
   10. Steam Flow (lb./hr)
   11. Air Pressure Drop (Inches w.g.)
   12. Tube Diameter (Inches)
   13. Tube Material
   14. Fin Height
   15. Fin Material
   16. Tube Wall Thickness
   17. Coil Section Dimensions (Inches)
   18. Coil Weight
   19. Frame Material

E. Fan Sound Power at AHU
   (at design cfm) at AHU
   (at design cfm) at AHU
   (at design cfm) at AHU
   (at design cfm) at AHU
   (at design cfm) at AHU
   1st Octave Inlet Outlet

Milam County Annex
Cameron, Texas 23 73 13 -9 Modular Air Handling Units
2nd Octave

3rd Octave

4th Octave

5th Octave

6th Octave

7th Octave

8th Octave

20. Fan BHP (at design cfm)
   a. (with clean filters)
21. Fan BHP (at design cfm)
   a. (with fully loaded filters)
22. Motor Horsepower
23. Motor Efficiency (at design cfm)
24. Motor Efficiency (at 50 percent of design)
25. Motor Manufacturer and Model Number
26. Bearing Manufacturer and Model Number
27. Attach Manufacturer's Literature on:
   a. Fan
   b. Fan Curve at full RPM (design cfm)
   c. Fan Curve at minimum recommended RPM
   d. Motor
   e. Fan Bearings
   f. Fan Drive
   g. Vibration Isolation
   h. cfm vs. Total Unit kW Curve with Clean Filters for Fan
   i. cfm vs. Total Unit kW Curve with Fully Loaded Filters for Fan

F. Cooling Coil:
1. Manufacturer
2. Air Flow (cfm)
3. Face Velocity
4. Air Entering Temperature (degrees F)
   a. Dry Bulb
   b. Wet Bulb
5. Air Leaving Temperature (degrees F)
   a. Dry Bulb
   b. Wet Bulb
6. Fins per Inch (9 maximum)
7. Rows (6 maximum)
8. Minimum Coil Capacity Sensible/Total (Btuh)
9. Rated Coil Capacity (Btuh)
10. Entering Water (gpm)
11. Entering Water Temperature (degrees F)
12. Leaving Water Temperature (degrees F)
13. Water Side Pressure Drop (Feet w.g.)
14. Air Side Pressure Drop (wet) (Inches w.g.)
15. Water Velocity (ft/min)
16. Number of Sections
17. Tube Diameter (Inches)
18. Tube Material
19. Fin Height
20. Fin Material
21. Tube Wall Thickness
22. Coil Section Dimensions (Inches)
23. Coil Weight
24. Frame Material
25. Finish

G. Heating Coil:
1. Manufacturer
2. Air Flow (cfm)
3. Face Velocity
4. Air Entering Temperature (degrees F)
5. Air Leaving Temperature (degrees F)
6. Fins per Inch (9 maximum)
7. Rows (2 maximum)
8. Minimum Coil Capacity Sensible/Total (Btuh)
9. Rated Coil Capacity (Btuh)
10. Entering Water (gpm)
11. Entering Water Temperature (degrees F)
12. Leaving Water Temperature (degrees F)
13. Water Side Pressure Drop (Feet w.g.)
14. Air Side Pressure Drop (wet) (Inches w.g.)
15. Water Velocity (ft/min)
16. Number of Sections
17. Tube Diameter (Inches)
18. Tube Material
19. Fin Height
20. Fin Material
21. Tube Wall Thickness
22. Coil Section Dimensions (Inches)
23. Coil Weight
24. Frame Material
25. Finish

H. Flow Element:
1. Type
2. Certified Accuracy
3. Pressure Drop

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 & Division 20 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. Perform all Work required to provide and install computer room air conditioning units (CRACU), including factory installed variable speed controlled fans, isolation dampers, coils, motors, and any specialty equipment as indicated in the Contract Documents with supplementary items necessary for proper installation.
B. This Section includes factory-assembled direct expansion (DX) air conditioning system, but is not limited to, the following:
   1. Air handler.
   2. Outdoor condensing unit.
   3. Thermostat.
   4. Accessories.

1.3 REFERENCE STANDARDS
A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:
   2. AMCA 211 - Certified Ratings Program
   4. ARI 270 - Sound Rating of Outdoor Unitary Equipment.
   5. NFPA 70 - National Electrical Code.
   7. NFPA 90B - Installation of Warm Air Heating and Air-Conditioning Systems
   8. UL - Underwriters Laboratories.

1.4 QUALITY ASSURANCE
A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with minimum three (3) years documented experience.
B. Installer Qualifications: Company specializing in performing the Work of this Section with minimum three (3) years experience approved by manufacturer.

1.5 SUBMITTALS
A. Product Data:
   1. Provide data that indicates physical dimensions, weights, component capacities, efficiency ratings, fan performance, materials gages and finishes of panels, electrical conduit, and piping size connections.
2. Provide information concerning the location of maintenance access panels, minimum clearance requirements for proper operation of equipment and components.

3. Provide fan curves with specified operating point clearly plotted, as tested and certified per AMCA 211 standards. Ratings to include system effects. Bare fan ratings will not satisfy this requirement, but shall be submitted for comparison purposes. All fan data shall be generated from specified testing. The fan shall compare favorably with the scheduled data listed in the Drawings.

4. Submit sound power level data for both fan outlet and casing radiation at rated capacity, as tested and certified per AMCA 300 and ARI 260 standard for ducted units and DX units with compressors inside the unit casing. All fan data shall be generated from specified testing. The fan shall compare favorably with the scheduled data listed in the construction Drawings. The selected unit will not exceed the scheduled sound power data.

5. Unit manufacturer shall submit full sound performance data to the Project sound consultant for evaluation. Unit shall be finally configured so as not to exceed sound levels as scheduled on Contract Documents.

6. Provide data on all coils as tested and certified per ARI standards.

7. Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

8. All materials shall have NFPA-90 rating of 25/50 or better.

9. Manufacturer's Instructions: Provide start-up information and maintenance required prior to start-up.

B. Record Documents:
   1. Submit under provisions of Division 01.
   2. Shop Drawings: Indicate manufactured products, assemblies, and accessories. Indicate water, drain, chilled water, location of valves, rough-in piping, and electrical and connection requirements.

C. Operation and Maintenance Data:
   1. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.

1.6 WARRANTY
   A. Provide five-year manufacturer's replacement warranty.

PART 2 - PRODUCTS

2.1 GENERAL
   A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

2.2 MANUFACTURERS
   A. Trane
   B. Daikin
   C. LG

2.3 AIR HANDLERS
   A. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect.
   B. Discharge: Ducted.
   C. Insulation: Faced, glass-fiber, duct liner.
   D. Drain Pans with connection for drain; insulated.
   E. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.
F. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements with refractory ceramic support bushings; automatic-reset thermal cutout; built-in magnetic contactors; manual-reset thermal cutout; airflow proving device; and one-time fuses in terminal box for overcurrent protection.

G. Fan: Direct drive, centrifugal, with power-induced outside air.

H. Special Motor Features: Multitapped, multispeed with internal thermal protection and permanent lubrication.

I. Filters: Minimum 1-inch thick, in fiberboard frames.

J. Refrigeration System
   a. Air handling unit and matching condensing unit shall be capable of operation as an R-410A split system heat pump.
   b. Each refrigeration circuit shall be equipped with thermostatic expansion valve type refrigerant flow control.
   c. Unit shall be configured as heat pump. Refrigeration circuit shall be equipped with thermal expansion and check valve on the indoor coil.
   d. Refrigeration circuit shall be equipped with a liquid line sight glass.

2.4 AIR-COOLED, COMPRESSOR-CONDENSER COMPONENTS
   a. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
   b. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
   c. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.
   d. Fan: Aluminum-propeller type, directly connected to motor.
   e. Motor: Permanently lubricated, with integral thermal-overload protection.
   f. Mounting Base: Polyethylene.

PART 3 - EXECUTION

3.1 PREPARATION
   A. Verify that flooring system is ready to receive Work and that opening dimensions are as indicated on Shop Drawings.
   B. Verify that proper power supply is available.

3.2 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 manufacturer’s published recommendations.
   C. Contractor shall coordinate installation of computer room air conditioning units with computer room raised floor installer.
   D. Provide adequate drainage connections for [water cooled condensers] [coil condensate] [chilled water coils] and [humidifier blow down].
   E. Provide shut-off valves at water inlet and outlet piping on DX units equipped with water cooled condensers.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

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. Drawings are necessarily diagrammatic by their nature and are not intended to show every connection in detail or every pipe or conduit in its exact location. Carefully investigate structural and finish conditions and coordinate the separate trades in order to avoid interference between the various phases of Work. Organize and lay out Work so that it will be concealed in furred chases and suspended ceilings, etc., in finished portions of the building, unless specifically noted to be exposed. Install all Work parallel or perpendicular to building lines unless otherwise noted.

B. The intent of the Drawings is to establish the types of systems and functions; not to set forth each item essential to the functioning of the system. Install the Work complete, including minor details necessary to perform the function indicated. Review pertinent Drawings and adjust the Work to conditions shown. Where discrepancies occur between Drawings, Specifications, and actual field conditions, immediately notify the Owner's Project Manager for Owner's interpretations.

C. Coordinate the actual locations of electrical outlets and equipment with building features and equipment as indicated on architectural, structural, mechanical, and plumbing Drawings. Review any proposed changes in electrical wiring devices or equipment location with the Owner's Project Manager. Owner may direct relocation of outlets before installation, up to five (5) feet from the position indicated, without additional cost. Remove and relocate outlets placed in an unsuitable location when requested by the Owner, at no additional cost to the Owner.

D. All dimensional information related to new structures shall be taken from the appropriate Drawings. All dimensional information related to existing facilities shall be taken from actual measurements made by the Contractor on the Site.

1.3 REFERENCE STANDARDS

A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.

B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.

C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the Contract Documents and the following references.


1.4 DEFINITIONS

A. Concealed: Concealed areas are those areas that cannot be seen by building occupants.

B. Exposed: Exposed areas are all areas that are exposed to view by building occupants, including areas below counter tops, inside cabinets and closets, inside all equipment rooms, and areas outside the building exterior envelope, exposed to the outdoors.

1.5 QUALITY ASSURANCE

A. Regulations: Work, materials and equipment shall comply with the latest rules and regulations specified in National Fire Protection Association (NFPA).
B. Discrepancies: The Drawings and Specifications are intended to comply with listed codes, ordinances, regulations and standards. Where discrepancies occur, immediately notify the Owner’s Project Manager in writing and ask for an interpretation. Should installed materials or workmanship fail to comply, the Contractor is responsible for correcting the improper installation at no additional cost to the Owner. Additionally, where sizes, capacities, or other such features are required in excess of minimum code or standards requirements, provide those specified or shown.

C. Contractor Qualifications: An acceptable Contractor for the Work under this Division must have personnel with experience, training and skill to provide a practical working system. The Contractor shall furnish acceptable evidence of having installed not less than three systems of size and type comparable to this Project. All personnel installing equipment under this Division shall possess valid licenses for their skill level. Each Journeyman shall supervise no more than two apprentice helpers. Refer also to Owner’s Special Conditions.

1.6 SUBMITTALS

A. Product Data: Provide coordination Drawings with submittals as required by Division 01.
B. Record Documents: In addition to hard copy format, all material submitted as final record products, including approved Shop Drawings and submittals, shall be submitted to the Owner in its original electronic file format on compact disc or DVD. Material may be scanned into electronic file format where necessary.

1.7 DELIVERY, STORAGE AND HANDLING

A. All equipment and materials shall be delivered to the Project Site clean and sealed for protection.
B. Moisture: During construction, protect switchgear, transformers, motors, control equipment, and other items from insulation moisture absorption and metallic component corrosion by appropriate use of strip heaters, lamps or other suitable means. Apply protection immediately upon receiving the products and maintain continually.
C. Damage: Take such precautions as are necessary to protect apparatus and materials from damage. Failure to protect materials is sufficient cause for rejection of the apparatus or material in question.
D. Finish: Protect factory finish from damage during construction operations until acceptance of the Project. Restore any finishes that become stained or damaged to Owner’s satisfaction.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
B. Equipment and control systems should match, integrate, communicate or cooperate with other systems such as power monitoring systems, building automation, fire alarm, motor control centers, switchgears, breakers, transformers, and lighting dimming systems.
C. Conditions: Provide new products of manufacturers regularly engaged in production of such equipment. Provide the manufacturer's latest standard design for the type of product specified. Products shall be U.S. made. Owner reserves the right to approve or disapprove foreign-made products.
D. NEC and UL: Products shall conform to requirements of the National Electrical Code. Where Underwriters' Laboratories have set standards, listed products and issued labels, products used shall be listed and labeled by UL.
E. Space Limitations: Equipment selected shall conform to the building features and shall be coordinated with all components. Do not provide equipment that will not meet arrangement and space limitations. Contractor shall submit room layouts with submitted items shown drawn to scale. Submittals will be rejected without floor plan Drawings showing submitted items.
F. Factory Finish: Equipment shall be delivered with a hard surface, factory-applied finish so that no additional field painting is required except for touch-up.
G. Series Ratings: Overcurrent devices shall have fully rated interrupting capacity. Series rating of devices is unacceptable.

2.2 EQUIPMENT AND DEVICE MARKING

A. Designations: Externally mark all equipment, devices, feeders, branch circuits and similar items with nameplates with the same designations as indicated on the Contract Documents.

B. Nameplates shall be black laminated rigid phenolic with white core. Nameplate minimum size shall be 1 inch high by 3 inches long with 3/16 inch high engraved white letters. Supply blank nameplates for spare units and spaces.

C. Nameplate Fasteners: Fasten nameplates to the front of equipment only by means of stainless steel self-tapping screws. Stick-ons or adhesives are not acceptable unless the NEMA enclosure rating is compromised, then only epoxy adhesive shall be used to attach nameplates.

D. Nameplate Information: The general naming convention shall consist of the following segments:
   1. Building name in abbreviated form where equipment is located;
   2. Building floor where electrical equipment is located;
   3. System voltage: H (277/408V) or L (120/208V).
   4. Individual equipment identification: A, B, C, etc.

E. In general, provide the following information for the types of electrical equipment as listed:
   1. Switchgears, Switchboards, Distribution Panels and Motor Control Centers: On mains, identify the piece of equipment, the source, and voltage characteristics (i.e., 480/277V 3PH 4W). For each branch circuit protective device, identify the load served.
   2. Transformers, Individual Starters, Contactors, Disconnect Switches, Transfer Switches and Similar Equipment: Identify the device designation, voltage characteristics source and load served.
   3. Panelboards: Identify panelboard designation, voltage characteristics, and source designation.

F. Panelboards: Prepare a neatly typed circuit directory behind clear heat-resistant plastic in a metal frame tack welded to the inside of the door for each panelboard. Identify circuits by equipment served and by building room numbers where room numbers exist. Indicate spares and spaces with light, erasable pencil marking. Adhesive mounted directory pocket is not acceptable. Removing and attaching panel schedules from the Drawings is not acceptable.

G. Panelboards, Pull, Junction and Outlet Boxes:
   1. With ½ inch high permanent lettering, identify conduits connected to panelboards, pull, junction and outlet boxes with the complete circuit number of the conductors contained therein. Neutral conductors shall be identified by wire marker tags in the panelboards, pull, junction and outlet boxes. Where multiple circuits are contained in a box, identify the circuit conductors with permanent tags which indicate circuit designation.

H. Power receptacles, wall switches and dedicated outlets. Identify circuits as per Specification Section 26 27 26.

I. Dedicated outlets: Dedicated is understood to be specific equipment listed by equipment number in the panel schedules or identified on the Drawings. Dedicated also includes computer outlets.

J. Remote Ballasts: For remote ballasts not within five (5) feet of their associated lighting fixture, provide appropriate permanent lettering on both the ballasts and the light fixture to identify which are mated to the other.

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. Installation shall be in accordance with manufacturer’s published recommendations.
C. Cooperation with Other Trades: Cooperate with trades of adjacent, related or affected materials or operations, and with trades performing continuations of this Work in order to effect timely and accurate placing of Work and to coordinate, in proper and correct sequence, the Work of such trades.

D. Workmanship: Work shall be performed by competent workers skilled in their trade. This installation must be complete.

E. Housekeeping Pads: Unless otherwise noted. Install 3 1/2 inch thick concrete foundation pads for indoor floor-mounted equipment, except where direct floor mounting is required. Pour pads on roughened floor slabs, sized so that outer edges extend a minimum of 3 inches beyond equipment. Trowel pads smooth and chamfer edges to a 1 inch bevel. Secure equipment to pads as recommended by the manufacturer.

F. Setting of Equipment: Equipment must be leveled and set plumb. Sheet metal enclosures mounted against a wall must be separated from the wall not less than 1/4 inch by means of corrosion-resistant spacers or by 3 inches of air for freestanding units. Use corrosion resistant bolts, nuts and washers to anchor equipment. Provide Drawings and layout Work showing exact size and location of sleeves, openings or inserts for electrical equipment in slabs, walls, partitions and chases in sufficient time to be coordinated with Work under other divisions.

G. Sealing of Equipment: Seal openings into equipment to prevent entrance of animals, birds and insects.

H. Motors: Electrical Work includes the electrical connection of all motors, except those that are wired as a part of equipment.

I. Concealed Work: Conceal all electrical Work in walls, floors, chases, under floors, underground, and above ceilings except:
   1. Where shown or specified to be exposed. Exposed is open to view.
   2. Where exposure is necessary to the proper function.
   3. Where size of materials and equipment preclude concealment.

J. Transformers: Use transformers to change the service to the required utilization voltages.

K. Provide final electrical connections to equipment furnished under other divisions and by the Owner. Furnish detailed Shop Drawings of equipment indicating the exact number and location of rough-in points. Such final Shop Drawings may indicate adjustments in total number and exact location of rough-in points, and in equipment dimensions. Making adjustments to field conditions is considered a part of the Work required.

L. Roughing-in: When roughing-in electrical branch circuits to various items of equipment, terminate at proper points as indicated on detailed equipment Shop Drawings or as directed by Owner. Do not rely on Drawings accompanying these Specifications for rough-in locations, only for general routing of circuiting.

M. All unused openings such as but not limited to, knockouts on panels and boxes, surface wireway openings, busway openings, circuit breaker empty slots shall be covered with approved cover plates.

N. Temporary power equipment and distribution for construction shall not occupy building spaces or block pathways that are designated for permanent installation of other trades according to design drawings.

3.2 TESTING

A. Test Conditions:
   1. Place circuits and equipment into service under normal conditions, collectively and separately, as may be necessary to determine satisfactory operation. Perform specified tests in the presence of the Owner's representative(s). Furnish all instruments, wiring, equipment and personnel required for conducting tests. Demonstrate that the equipment operates in accordance with requirements of the Contract Documents. Special tests on certain items are specified hereinafter.
   2. Where specified that the testing be performed by an independent testing company, an Owner-approved National Electrical Testing Association (NETA) certified testing company shall be used. Submit copies of test reports.
3. Prior to testing, Contractor shall submit to Owner for approval, installation verification Prefunctional Checklists and Functional Performance Test procedures. These shall be used for documentation as part of the commissioning process.

4. All instruments required for conducting the tests shall be NIST (National Institute for Standard and Technology) certified or traceable, and calibrated at the time of testing.

B. Test Dates: Schedule final acceptance sufficiently in advance of the Contract date to permit completion of any necessary adjustment or alterations within the number of days allotted for completion of the Contract. Provide written notification to Owner at least fourteen (14) calendar days in advance of Functional Performance Test dates.

C. Retests: If retesting is required due to initial failure, conduct retests of such time duration as may be necessary to assure proper functioning of adjusted or altered parts or items of equipment. Any resultant delay as a result of such necessary retests does not relieve the Contractor of Contractor's responsibility under this Contract.

D. Circuit Verification: All 120-volt single-phase circuits shall be verified to match the Drawings and panel schedules by “ringing out” each circuit in the presence of the Owner's representative(s).

E. Refer to Commissioning Specification Sections for additional start-up, prefunctional and operational checkout, and for functional performance test procedures.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary
      Conditions and Division 01 Specification Sections, apply to this Section.
   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. This Section specifies the requirements for 600-volt cable, wire and connectors. It consists
      of but is not limited to power distribution circuitry, control system circuitry, lighting circuitry,
      appliance, equipment and motor-branch circuitry and outdoor power and lighting circuitry.

1.3 REFERENCE STANDARDS
   A. The latest published edition of a reference shall be applicable to this Project unless identified
      by a specific edition date.
   B. All reference amendments adopted prior to the effective date of this Contract shall be
      applicable to this Project.
   C. All materials, installation and workmanship shall comply with the applicable requirements
      and standards addressed within the following references:
      1. NEMA WC 3: Rubber-Insulated Wire and Cable for the Transmission and Distribution
         of Electrical Energy.
      2. NEMA WC 5: Thermoplastic-Insulated Wire and Cable for the Transmission and
         Distribution of Electrical Energy.
      3. Where application of National Electrical Code, appears to be in conflict with the
         requirements of this section, the Owner shall be asked for an interpretation.

1.4 SUBMITTALS
   A. Product Data:
      1. Submit manufacturer’s data on cable and wire connectors.

1.5 DELIVERY, STORAGE AND HANDLING
   A. Provide factory-wrapped waterproof flexible barrier material for covering wire and cable
      wood reels, where applicable; and weather resistant fiberboard containers for factory-
      packaging of cable, wire and connectors, to protect against physical damage in transit.
      Damaged cable, wire or connectors shall be removed from the Project Site.
   B. In their factory-furnished coverings, store cable, wire and connectors in a clean, dry indoor
      space which provides protection against the weather.

PART 2 - PRODUCTS

2.1 GENERAL
   A. All materials shall meet or exceed all applicable referenced standards, federal, state and
      local requirements, and conform to codes and ordinances of authorities having jurisdiction.
B. Provide factory-fabricated wire of the size, rating, material and type as indicated for each service. Where not indicated, provide proper selection as required to comply with installation requirements and with NEC standards. The minimum size wire to be used for power or lighting circuits shall be #12 copper stranded with insulation as noted below. Minimum size for control circuits shall be #14 copper stranded.

2.2 MANUFACTURERS

A. Interstate Wire Company.
B. American Insulated.
C. Okonite.
D. Southwire.
E. Encore Wire.

2.3 BUILDING WIRE

A. NEMA WC 70 – Nonshielded 0-2kV Cables
B. Feeders and Branch Circuits Larger than 10 AWG: 98 percent conductivity copper, stranded conductor, 600-volt insulation, THHN/THWN. Use XHHW insulation for all isolated power circuits.
C. Feeders and Branch Circuits 10 AWG and smaller: 98 percent conductivity copper conductor, 600-volt insulation, THHN/THWN solid conductor. Use XHHW insulation for all isolated power circuits.
D. Control Circuits: 98 percent conductivity copper, stranded conductor, 600 volt insulation, THHN, THWN.
E. Color Coding:
   1. Branch Circuit and Feeders:
      | 280Y/120 Volts | 480Y/277 Volts | 120/240 Volts |
      | Phase A | Red | Brown | Black |
      | Phase B | Black | Yellow | Red |
      | Phase C | Blue | Purple | ---- |
      | Neutral | White with tracer | Gray with tracer | White with tracer |
      | Ground | Green | Green | Green |
   2. The above colors shall be used unless requirements of code require different colors. When connecting to existing circuits, existing color coding shall be utilized. The neutral tracer color shall match the phase conductor color that it is associated with. Lighting circuits with shared grounding conductor are not required to have tracer colors on the wire.
   3. Secondary conductors from isolation transformers shall be: Conductor 1-orange and conductor 2-brown.
   4. Conductors No. 8 AWG and larger shall be identified by colored plastic tape that matches the circuit phase color at all visible points when colored insulation is unavailable. Colored tape shall be located and of such a quantity to readily indicate the conductor phase.
F. Type MC cable assemblies shall be permitted only with Owner’s prior written approval and with proper cable management.

2.4 REMOTE CONTROL AND SIGNAL CABLE

A. Control Cable for Class 1 Remote Control and Signal Circuits: 98 percent conductivity copper conductor, 600-volt insulation, rated 60 degrees C, individual conductors twisted together, shielded and covered with a PVC jacket.
B. Control Cable for Class 2 or Class 3 Remote Control and Signal Circuits: 98 percent conductivity copper conductor, 300-volt insulation, rated 60 degrees C, individual conductors twisted together, shielded and covered with a nonmetallic jacket; UL listed for use in air handling ducts, hollow spaces used as ducts, and plenums.
PART 3 - EXECUTION

3.1 PREPARATION
A. Installer must examine the areas and conditions under which cable, wire and connectors are to be installed and notify the Contractor and Owner in writing of conditions detrimental to the proper and timely completion of the work.
B. Inspect wire and cable for physical damage. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 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 manufacturer’s published recommendations.
C. General wiring methods:
   1. Install electrical cable, wire and connectors as indicated, in accordance with the manufacturer’s written instructions, the applicable requirements of NEC, and as required to ensure that products serve the intended functions.
   2. Coordinate cable and wire installation work with electrical raceway and equipment installation work, as necessary for proper interface.
   3. Cables shall be selected on the basis of their purpose and UL listing. Generally, use Types THWN, XHHW and THHN in building interiors and other dry locations. Outdoors and in underground in raceways, use Type THWN or THHN. Conductors subject to abrasion, such as in lighting poles, shall be Type THWN or THHN.
   4. No conductor smaller than No. 12 wire shall be used for branch circuit wiring. In the case of “homeruns” over 50 feet in length (100 feet for 277 volt), no conductor smaller than a No. 10 wire shall be used. The tap conductor from the J-box in the ceiling to the receptacle may be No. 12. Each 120-volt phase conductor shall have a neutral conductor of the same size. The sizing of all wire except remote control wire shall be accomplished in the case of both feeder and branch circuits by conforming to the following provisions. Only lighting circuits may share grounding conductors. All lighting circuits with shared grounding conductors shall be #10 AWG minimum.
      a. 480 Volt Branch Circuits: The voltage drop in the case of 277/480 volt circuits shall not exceed 1.0 percent at maximum load and 70.0 percent power factor.
      b. 120/208 Volt Branch Circuits: The voltage drop in the case of 120/208 volt circuits shall not exceed 2.0 percent at maximum load and 70.0 percent power factor.
   5. Remote control wires shall be no smaller than No.12 AWG stranded copper conductors and shielded with drain. Control wires shall be run in separate conduits. Departures from the sizes so determined shall be made only in those cases in which the National Electrical Code requires the use of larger conductors. The sizes as determined from these tables shall be regarded as the acceptable minimum under all other circumstances. In no case, however, shall there be a voltage drop greater than that specified in any feeder or branch circuit. This voltage drop shall be based on the full load, 70 percent power factor, the total impedance drop with 60-hertz alternating current and with the reactance drop in the respective metal conduits duly considered. The Contractor may, if Contractor deems it necessary or advisable, use larger sized conductors than those shown. Under no circumstances, however, shall the Contractor use any conductors sized in a manner which does not conform to the above mentioned tables without having first secured the written approval of the Owner’s duly authorized representative.
D. Wiring Installation Raceways:
   1. Wire and cable shall be pulled into clean dry conduit.
   2. Pull conductors together where more than one is being installed in a raceway.
   3. Use UL listed pulling compound or lubricant, when necessary; compound must not deteriorate conductor and insulation. No pulling compound shall be used when pulling isolated power circuits utilizing XHHW insulation.
4. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed. Wires with damaged insulation shall be replaced at no cost to the Owner.

5. Place an equal number of conductors for each phase of a circuit in same raceway.

6. No more than three phase conductors shall be installed in same conduit. Line conductors shall not share the same conduit with load conductors.

E. Wiring Connections and Terminations:
1. Splicing cable or wire is not allowed unless it is explicitly designed by the Engineer, or for equipment connection per equipment manufacturer's recommendation. Where splices are to be implemented, approval of the Owner must be obtained before installation is made. Provide electrical boxes where splices are made.

2. Thoroughly clean wires before installing lugs and connectors.

3. Terminate spare conductors with electrical tape.

F. Field Quality Control:
1. Torque test conductor connections and terminations to manufacturer's recommended values.

2. Perform continuity test on all conductors. Verify proper phasing connections and phase rotation, where applicable.

3. Conductors in vertical conduits or raceways shall be supported in the manner set forth in the appropriate section of the latest revision of the National Electrical Code. Lighting fixtures shall not be used for raceways for circuits other than series wiring of fixtures.

4. Conductors may be run parallel on sizes 1/0 to 500 kCMIL inclusive provided all parallel conductors are the same size manufacturer, length and type of insulation. Except as otherwise shown on Drawings, no more than three (3) conductors may be run in parallel, and they shall be so arranged and terminated as to ensure equal division of the total current between all conductors involved. Where parallel connection is contemplated, approval of the Owner must be obtained before installation is made.

3.3 TESTING

A. Before final acceptance, the Contractor shall make voltage, insulation and load tests, necessary to demonstrate to the Owner the satisfactory installation and proper performance of all feeder circuits.

B. Test feeder conductors to determine the conductors are clear of faults, high resistance connections and megger test same at 600 volts DC. Test results below 30 megohms shall be cause for rejection of the wiring installation. Replace and retest all such rejected conductors.

END OF SECTION
SECTION 26 05 26
GROUNDING & BONDING

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. Ground the electrical service system neutral at service entrance equipment to grounding counterpoise loop. Electrical systems that are grounded shall be connected to earth in a manner that will limit the voltage imposed by lightning, line surges, or unintentional contact with higher-voltage lines and that will stabilize the voltage to earth during normal operations. Provide a completely grounded system in accordance with Article 250 of the NEC.

B. Metal water piping system(s) installed in or attached to a building or structure shall be bonded to the service equipment enclosure, the grounded conductor at the service. Where installed in or attached to a building or structure, a metal piping system(s), including gas piping, that is likely to become energized shall be bonded to the service equipment enclosure, the grounded conductor at the service. The bonding jumper(s) shall be sized in accordance with Article 250 of the NEC.

C. Ground each separately-derived system neutral to separate ground buses that are installed in nearest electrical rooms. Transformers, inverters, or other power supplies that are separately derived systems.

D. Concrete reinforcing bars shall be permitted for grounding. Connect the structural metal frame to the reinforcing bars of concrete-encased electrode. Concrete-encased electrodes of existing buildings or structures shall not be required to be part of the grounding electrode system where the steel reinforcing bars or rods are not accessible for use without disturbing the concrete.

E. Provide communications system-grounding conductor at point of service entrance and connect to Telecommunications Main Grounding Busbar (TMGB). Bond together the communications system grounding.

F. Bond together system neutrals, service equipment enclosures, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, metal cable trays, auxiliary gutters, meter fittings, boxes, cable armor, cable sheath, ground bus in electrical rooms, metal frame of the building or structure, ground ring, lightning down lead conductor, grounding conductor in raceways and cables, receptacle ground connectors, and metallic plumbing systems.

G. Common Ground Bonding with Lightning Protection System: Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

H. Metal Poles Supporting Outdoor Lighting Fixtures: Provide a grounding electrode in addition to installing a separate equipment grounding conductor with supply branch-circuit conductors.

1.3 REFERENCE STANDARDS

A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.

B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
C. All design, materials, installation and testing pertaining to grounding and bonding system shall comply with the latest edition of applicable requirements and standards addressed within the following references:

2. UL 467 - Grounding and Bonding Equipment.
5. NFPA 70 - National Electrical Code (NEC).
7. LPI (Lightning Protection Institute) 175- Standard of Practice for the Design - Installation - Inspection of Lightning Protection Systems.
8. UL 96 - Lightning Protection Components.
13. UL 497 - Protectors for Paired-Conductor Communications Circuits.
14. UL 497A - Secondary Protectors for Communications Circuits.
15. UL 497B - Protectors for Data Communications and Fire-Alarm Circuits.

1.4 SUBMITTALS
A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections:
   1. Product Data: For the following:
      a. Ground rods.

1.5 QUALITY ASSURANCE
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
   1. Comply with UL 467.
B. Comply with NFPA 70; for overhead-line construction and medium-voltage underground construction, comply with IEEE C2.
C. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.

PART 2 - PRODUCTS

2.1 GENERAL
A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

2.2 MATERIALS AND EQUIPMENT
A. Grounding system components shall be as required to comply with the design and construction of the system indicated. Components shall be as indicated in manufacturer's submittal data.
B. Ground Conductors:
   1. Materials:
a. Provide 600-volt insulated conductors having a green-colored insulation for grounding electrode and equipment grounding conductors. Use stranded conductors.

b. Conduit grounding conductors shall be insulated copper conductor, green in color to size #6 AWG. Insulated conductors larger than #6 AWG shall be same as phase conductors but identified with green tape at each accessible opening or location in raceway.

c. Provide bare conductors for bonding jumpers.

C. Connections:

1. Materials:
   a. Unless otherwise noted, for below-grade connections provide exothermic welded type except those at test wells.
   b. For above-grade connections provide mechanical bolted-type connections utilizing high conductive copper alloy or bronze lugs or clamps.
   c. Where required, provide plated connectors that will not cause electrolytic action between the conductor and the connector.
   d. Ground Rod Clamps at Test Wells: Use bolted pressure clamps with at least two bolts.

D. Grounding clips shall be O-Z Gedney, Steel City (Thomas & Betts) Type G.

E. Grounding Electrodes:

1. Grounding electrodes shall not be smaller than ¾-inch diameter, with minimum length ten (10) feet.
2. Grounding electrodes shall be copper-clad steel for corrosion protection.

F. Grounding Busbar:

1. Where a field-provided ground bus or ground bar is required, use round-edge copper bar with 98 percent International Annealed Copper Standard (IACS) conductivity.
2. Size the bus for not less than 25 percent of the cross-sectional areas of the related feeder. A minimum size of ¾-inch thick by 2-inch depth by 6-inch length (minimum) is required.
   a. The ground bar shall be a predrilled copper busbar provided with standard NEMA bolt hole sizing and spacing for the type of connectors to be used.
   b. The ground bar shall be tin-plated for reduced contact resistance.
   c. The ground bar shall be insulated from its support. A minimum of 2 inches separation is required. Mount the grounding busbars on insulated standoffs to ensure isolation from ground potential or stray potentials.

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 manufacturer’s published recommendations.

C. Install ground system as indicated, in accordance with the applicable requirements of the NEC. Coordinate installation of grounding and lightning protection system components with structural and civil Drawings and placement of building structure.

D. Install grounding conductors continuous, without splice or connection, between equipment and grounding electrodes.

E. Size: When grounding and bonding conductors are not sized on Drawings, size the grounding conductors in accordance with NEC. Size bonding jumper so that minimum cross-sectional area is greater than or equal to that of the equivalent grounding conductor as determined from NEC.

F. Ground Rods: Install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.

1. Drive ground rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.

G. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

H. Connect grounding electrode conductors to metal water pipe using suitable ground clamp. Make connections to flanged piping at street side of flange. Provide bonding jumper around water meter to electrically bypass.

I. Exothermic welding shall be utilized for ground connections where they are concealed, or inaccessible.

J. Strap grounding clamps shall not be used. A connection requiring bolting shall be made up with Monel metal bolts, washers and nuts. Connections shall be made only after surfaces have been cleaned, or ground to expose virgin metal.

K. Supplementary Grounding Electrode: Use effectively grounded metal frame of the building.

L. Provide grounding and bonding at Utility Company’s metering equipment in accordance with Utility Company’s requirements.

M. Conduit and raceway systems shall not be considered a ground path. Provide an internal insulated grounding conductor in all conduits and raceways. Size grounding conductors in accordance with the NEC. Where grounding conductor sizes are shown in excess of code requirements, provide conductor sizes as indicated.

N. In feeder and branch circuits, provide a separate, green, insulated equipment-grounding conductor with the circuit conductors. Terminate each end of the grounding conductor on a grounding lug, bus, or bushing.

O. Ground each outlet by the use of an approved grounding clip attached to the junction box in such a position to be readily inspected on removal of the cover plate, or by the use of an approved grounding yoke type receptacle.

P. Install an insulated grounding conductor internally to all flexible metal conduits. All flexible metal conduit containing power circuits shall utilize grounding bushings. The grounding bushing shall contain a bonding jumper and shall be terminated at the equipment ground bus. The grounding conductor shall terminate at the equipment ground bus. Install external ground wire on liquid tight flexible metal conduit. Provide suitable grounding bushing at each end of liquid tight flexible metal conduit at transformers. External ground wire shall be in addition to grounding conductors installed internal to raceway system.

Q. Where accessible, conductor connections shall be made by means of solder-less connectors such as serrated bolted clamps or split bolt and nut type connectors.

R. Gas pipes shall not be used as a grounding electrode. Gas pipes shall not be used as a grounding electrode. Bond each aboveground portion of gas piping system upstream from equipment shutoff valve.

S. Install one test well for each service at the ground rod electrically closest to the service entrance. Set top of well flush with finished grade or floor.

T. Measure ground resistance from neutral connection at service entrance to ground reference point using suitable grounding testing equipment. Resistance shall not exceed 5 OHMS.

3.2 CONNECTIONS

A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.

2. Make connections with clean, bare metal at points of contact.

3. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

E. Connections at Test Wells: Use compression-type connectors on conductors and make bolted- and clamped-type connections between conductors and ground rods.

F. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

G. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

H. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.3 FIELD QUALITY CONTROL

A. System Neutral: Where a system neutral is used, bond the system neutral to the grounding electrode system in accordance with NEC. Ground the system neutral only at the point of service and isolate it from ground at all other points in the system.

B. Separately Derived Systems: Ground neutrals of separately derived systems such as generators, transformers, etc., in accordance with NEC.

C. The neutral of each transformer shall be bonded to system ground at one point only. This point shall be ahead of the first secondary protective device.

D. Size: Size the system grounding electrode conductors to comply with NEC.

E. Connect grounding electrode conductor pigtails at each grounding electrode to building structural steel, as indicated.

F. Connect main grounding electrode conductor pigtails to power system neutral, as indicated on Drawings.

G. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

H. Testing: Perform the following field quality-control testing:

I. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.

J. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE 81.

K. Provide drawings locating each ground rod and ground rod assembly and other grounding electrodes, identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

1. Equipment Rated 500 kVA and Less: 10 ohms.
2. Equipment Rated 500 to 1000 kVA: 5 ohms.
3. Equipment Rated More Than 1000 kVA: 3 ohms.
5. Manhole Grounds: 10 ohms.

L. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Owner representative promptly and include recommendations to reduce ground resistance such as a chemical ground system or others that are available and approved by the Consulting Engineer.

3.4 GRADING AND PLANTING

A. Restore surface features, including vegetation, at areas disturbed by Work of this Section. Reestablish original grades, unless otherwise indicated. If sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Comply with Section 32 90 00 - "Planting." Maintain restored surfaces. Restore disturbed paving as indicated.

3.5 UNDERGROUND DISTRIBUTION SYSTEM GROUNDING

A. Manholes and Handholes: Install a driven ground rod close to wall and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide a No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.

B. Connections to Manhole Components: Connect exposed-metal parts, such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

C. Pad-Mounted Transformers and Switches: Install two ground rods and counterpoise circling pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Use tinned-copper conductor not less than No. 2 AWG for counterpoise and for taps to equipment ground pad. Bury counterpoise not less than 18 inches below grade and 6 inches from the foundation.

3.6 EQUIPMENT GROUND

A. Manholes:
   1. Provide a No. 1/0 AWG bare stranded copper ground bus in all manholes. Mount bus 12 inches above floor using one-hole pipe straps three (3) feet on center.
   2. Connect bus to ground rod with a No. 1/0 AWG conductor. Bond all metallic components and electrical grounding conductors to the bus using lugs or clamps.

B. Transformer Rooms, Electric Rooms, Switchgear Rooms:
   1. Provide 4/0 copper ground wire loop in each room for bonding and grounding.
   2. Mount ground loop 12 inches below suspended ceiling or structural ceiling and around the perimeter of room.
   3. Connect ground loop to vertical ground bus (cable) riser grounding plate. Bond all non-current carrying metallic parts of electrical equipment in the room to the ground loop by bonding jumper(s) sized in accordance with Article 250 of the NEC.
   4. Raceway Systems and Equipment Enclosures:
   5. Ground cabinets, junction boxes, outlet boxes, motors, controllers, raceways, fittings, switchgear, transformer enclosures, other electrical equipment and metallic enclosures. Ground equipment and enclosures to the continuous-grounded metallic raceway system in addition to any other specific grounding shown.
6. Provide bonding jumpers and ground wire throughout to ensure electrical continuity of the grounding system,

7. Provide grounding-type insulated bushings for metal conduits 1-1/2 inches and larger terminating in equipment enclosures containing a ground bus and connect the bushing to the ground bus.

8. Provide a green insulated equipment-grounding conductor for each feeder and branch circuit.

C. Taps and Connections: Make grounding (earth) conductor approximately 2 inches longer than the ungrounded (phase) conductors at both ends.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Supporting devices, including:
   1. Conduit and equipment supports.
   2. Fastening hardware.

1.2 COORDINATION
A. Coordinate size, shape and location of concrete pads with section on cast-in-place concrete.

1.3 QUALITY ASSURANCE
A. Provide support systems adequate for weight of equipment and conduit, including wiring which they carry.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. B-Line.
B. Kindorf.
C. Unistrut.

2.2 MATERIAL
A. Support Channel: Galvanized or painted steel.
B. Hardware: Galvanized or painted steel.
C. Spring steel clips.

PART 3 - EXECUTION

3.1 INSTALLATION
A. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using expansion anchors, beam clamps or bolts.
B. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; sheet metal screws in sheet metal studs and wood screws in wood construction.
C. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit.
D. Do not use powder-actuated anchors on new concrete structure.
E. Do not drill structural steel members.
F. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.
G. Provide concrete pads and equipment bases for all outdoor equipment on grade, floor mounted equipment, areas with floors below grade, penthouse equipment rooms and where shown on Drawings.

H. Install surface-mounted cabinets and panelboards with minimum of four anchors.

I. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.

J. Do not support conduit from ceiling wire supports.

K. Do not use spring steel clips and clamps or support conduits by individual hanger wires.

L. Where multiple runs of conduit can be run grouped together, run conduit in racks supported from the building structure. Provide for future use of rack by properly planning routing of conduits in and through restricted areas such as through walls and around mechanical and electrical equipment.

M. Use spring steel clips with EMT for individual branch circuits and device boxes in drywall construction.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
   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. This Section specifies the requirements for raceways, conduits and boxes.

1.3 REFERENCE STANDARDS
   A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
   B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
   C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:
      1. ANSI C80.1 - Rigid Steel Conduit, Zinc-Coated.
      2. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.
      3. ANSI/NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.
      4. ANSI/NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports.
      5. ANSI/UL 1 - Flexible Metal Conduit.
      6. ANSI/UL 5 - Surface Metal Raceways and Fittings.
      7. ANSI/UL 360 - Liquid-tight Flexible Steel Conduit.
      8. ANSI/UL 467 - Electrical Grounding and Bonding Equipment.
      9. ANSI/UL 797 - Electrical Metallic Tubing.
     10. ANSI/UL 870 - Wireways, Auxiliary Gutters and Associated Fittings.
     11. ANSI/UL 884 - Underfloor Raceways and Fittings.
     12. NEMA VE I - Metallic Cable Tray Systems.
     13. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
     14. UL - Rigid Metal Conduit.
     15. ANSI/UL 651 - Schedule 40 and 80 Rigid PVC Conduit.

1.4 QUALITY ASSURANCE
   A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
   B. Comply with NFPA 70.

1.5 SUBMITTALS
   A. Product Data:
      1. Submit manufacturer’s product data for raceways, conduits, outlet boxes, and wireways.
PART 2 - PRODUCTS

2.1 GENERAL
A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

2.2 WIREWAYS AND TERMINAL BOXES
A. Wireways and terminal boxes shall be of steel construction, oil-tight with knockouts.
B. Size shall be minimum 4 x 4 inches or as indicated on the Drawings.
C. Cover shall be hinged.
D. Fittings shall be so constructed to continue the "lay in" feature throughout the entire installation.
E. Provide all sheet metal parts with a rust-inhibiting phosphatizing primer coating and finished in gray enamel. All hardware shall be cadmium plated to prevent corrosion.
F. Inside Terminal Boxes: Provide 25-ampere, 300-volt industrial rated terminal blocks with marking strip. Mark strip with black ink identifying circuit connection. Provide nameplate on exterior of each terminal box indicating panelboard served.

2.3 CONDUIT AND FITTINGS
A. Manufacturers:
   1. Conduit and Electrical Metallic Tubing:
      a. Allied Tube & Conduit or equal.
   2. Fittings:
      a. Appleton Electric
      b. Midwest Electric Products
      c. O-Z/Gedney.
   3. Expansion Fittings:
      a. O-Z/Gedney Type DX
      b. Crouse-Hinds Type XC
      c. equal by Midwest Electric Products or Appleton Electric.
   4. Flexible Metal Conduit and Fittings:
      a. Anaconda Sealtite, Type UA.
B. Application:
   1. Conduit and fittings for all electrical systems on this Project shall include the following:
      a. Service entrance.
      b. Electrical power and lighting feeders.
      c. Electrical power and lighting circuits.
      d. Building automation systems (BAS).
      e. Fire alarm and signaling systems.
      f. Telecommunications rough-in system (minimum 6-inch bending radius for telecommunications conduits).
      g. Security systems.
      h. Other electrical systems, as identified on the Drawings.
C. For each electrical wireway system indicated, provide a complete assembly of conduit, tubing or duct with fittings including, but not necessarily limited to, connectors, nipples, couplings, locknuts, bushings, expansion fittings, and other components and accessories as needed to form a complete system of the type indicated.
D. Conduit fittings shall be designed and approved for the specific use intended. Conduit fittings, including flexible, shall have insulated throats or bushings. Rigid conduits shall have insulated bushings, unless grounding bushings are required by NEC Article 250-28. Grounding bushings shall have insulated throats.
E. Rigid metal conduit shall be hot-dipped galvanized. Fittings shall be threaded type. Expansion fittings shall be OZ Type DX.
F. Electrical metallic tubing shall be galvanized. Fittings shall be all steel set screw deep socket UL marked and approved for the application. Compression fittings uses shall be in, not limited to, wet damp and environmental areas type. Expansion fittings shall be OZ Type TX.

G. Flexible metal conduit and fittings shall be zinc-coated steel.

H. Liquid-tight flexible conduit and fittings shall consist of single strip, continuous, flexible interlocked, double-wrapped steel, galvanized inside and outside, forming smooth internal wiring channel with liquid-tight covering of flexible polyvinyl chloride (PVC). It shall be furnished with a sealing O-ring where entering an enclosure subject to moisture. Where O-Rings are used, ground type bushings shall be used in the box or enclosure.

I. Crimp type fittings are not acceptable.

J. Raceways such as electrical nonmetallic tubing (ENT) and liquid-tight flexible nonmetallic conduit (LFNC) are not acceptable for use on any Project.

2.4 WALL AND CEILING OUTLET BOXES

A. Manufacturers:
   1. Appleton Electric
   2. RACO-Hubbell
   3. Thomas & Betts – Steel City

B. Galvanized steel interior outlet wiring boxes of the type, shape and size, including depth of box, to suit each respective location and installation; constructed with stamped knockouts in back and sides, and with threaded holes with screws for securing box covers or wiring devices. Minimum switchbox depth shall be 2 inches. Outlet boxes for electrical power shall be 2-1/8 inches deep. Outlet boxes for communication (voice and data) shall be minimum 3-1/2 inches deep.
   1. Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes.
   2. Accessories shall be compatible with outlet boxes being used and shall meet requirements of individual situations.

C. Corrosion-resistant cast-metal weatherproof exterior outlet wiring boxes of the type, shape and size, including depth of box, with threaded conduit ends, cast metal faceplate with spring-hinged waterproof cap and corrosion-proof fasteners.

D. Outlet boxes in poured concrete shall be plenum type without holes and with reset knockouts. Where extension rings are used to offset conduit between wall reinforcing steel, joint between extension ring and box shall be sealed to prevent concrete from entering box during pour.

2.5 FLOOR BOXES

A. Manufacturers:
   1. RACO-Hubbell
   2. Wiremold
   3. FSR.

B. Boxes shall be NEMA OS 1, fully adjustable, minimum 1-1/2 inch depth for electrical power only; 4-1/2 inch minimum depth for communication.

C. Boxes shall conform to regulatory requirements for concrete-tight floor boxes.

D. Service fittings shall be as specified on Drawings.

E. Poke-thru box fittings shall maintain a minimum two-hour fire rating.

2.6 PULL AND JUNCTION BOXES

A. Boxes shall be galvanized sheet metal with screw-on cover and welded seams, stainless steel nuts, bolts, screws and washers.

B. Boxes larger than 12 inches in any dimension shall be panelboard code gauge galvanized steel with hinged cover.

C. Boxes shall be sized in accordance with NEC.
D. ALL OUTDOOR BOXES AND ENCLOSURE USED IN LAGOON/PIER SHALL BE NEMA 6P RATED. NO EXCEPTIONS.

2.7 SURFACE METAL RACEWAYS

A. Manufacturers: The Wiremold Company 3000 or 4000 Single-Channel System. Systems of other manufacturers may be considered equal if they meet all performance standards as specified herein. Wiremold 4000 shall be used for communication applications.

B. Raceway base and cover sections shall be UL Listed, manufactured of cold rolled steel, and finished in gray enamel.
   1. Raceway shall be a two-piece design with a metal base and a snap-on metal cover.

C. Furnish with all entrance fittings, elbows, end caps, covers, and device brackets and plates as indicated on the Drawings for a complete system.
   1. Fittings shall be finished in enamel to match the raceway.
   2. Fittings shall be supplied with a base where applicable to eliminate mitering.

D. Provide couplings, elbows, connectors, boxes, extension rings and outlet covers specifically designed for use with surface raceway system.

E. Provide factory fittings for vertical raceway riser connection to horizontal raceway runs. Such directional change fittings must accommodate required radius flex for Category 6a communication cable under both load and no load conditions.

F. All internal exposed surfaces within the raceway, including joints and covers shall be free of nicks, cuts, sharp edges, and other imperfections.

G. Grommets shall be used to accommodate building automation system cabling to critical equipment or as noted on Drawings.

H. Multiple raceways shall be provided for normal power, emergency power, and communication / critical alarm as noted on the Drawings.
   1. Raceway lengths shall be as shown on the Drawings.

I. Multi-Outlet Assembly Devices:
   1. Provide hospital grade, duplex receptacles mounted 12 inches on center unless noted otherwise. Unless otherwise noted, alternate circuits between receptacles.
   2. In laboratory applications, normal power receptacles shall have alternating colors for different circuits:
      a. Phase A = gray
      b. Phase B = brown
      c. Phase C = white
   3. Exceptions to the color would be single circuit raceway, which shall be white.
   4. Receptacles serving emergency circuits shall be red in color.
   5. Isolated ground receptacles shall be orange in color.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

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 manufacturer’s published recommendations.

C. Concrete metal hit anchor and fastener is an unacceptable fastening system for concrete, brick and block.

D. Where raceways penetrate fire-rated floors, sleeve and seal opening around raceway with UL listed firestop equal to fire rating of floor. Seal penetrations through all floors to provide and maintain a watertight installation. Conduit sleeves, where required, shall be two (2) trade sizes larger for proper sealing and extend 2 inches above the surface. Refer to Section 07 84 13 Penetration Firestopping and Section 09 29 00 Gypsum Drywall for sealing and firestopping requirements where raceways penetrate smoke, fire, and sound rated walls. The installation shall be in compliance with UL listed firestopping assembly.

E. Support all conduits and J-boxes above ceilings from the building structure. All J-boxes being installed above suspended ceilings must have a minimum of 12-inch clearance from the top of the ceiling grid except where approved by the Owner in writing prior to installation.

F. All openings through walls, roof, etc., shall be sleeved.
G. No raceways, metallic or non-metallic, flexible or rigid, shall be installed in any floor slab elevated above slab on grade. The only exception may be for the lighting grid in the parking deck areas of a parking garage.

H. Bushings and throats shall be installed for fittings, raceways, boxes or other enclosures prior to installing cables and wiring systems.

I. Provide raceway support in intervals not exceeding the maximum spacing per NEC.

3.2 INSTALLATION - CONDUIT

A. ALL CONDUIT IN DRIVE STATION BUILDING, RETURN STATION BUILDING, FILTRATION BUILDING AND PIER/WALKWAY IN LAGOON SHALL BE LIQUID TIGHT CONDUIT. NO EXCEPTION.

B. Install raceway and conduit system from point of origin in outlets shown, complete with offsets, pull boxes, junction boxes and fittings.

C. Installation of all new conduits must be minimum 12 inches from ceiling grid except where approved by Owner.

D. No raceway shall be run horizontally inside of walls or partitions. Exceptions: building perimeter walls under windows, clerestory panel walls, and where structural conditions do not allow vertical access to tops of walls. The contractor shall obtain written approval from the Owner for exceptions prior to installation.

E. Install rigid wall hot-dipped galvanized steel conduit. Minimum size shall be 3/4-inch unless noted otherwise on the Drawings. Minimum size for communication shall be 1-inch. The following exceptions are permitted:
   1. Electrical Metallic Tubing (EMT): In sizes 3/4-inch up to and including 4 inches, may be used inside dry locations where not subject to mechanical damage. EMT shall be used in air-conditioned spaces, such as accessible ceilings, and dry wall partitions. EMT shall not be used outside, in concrete, underground, in underfloor spaces, in masonry walls and in locations likely to be damp. EMT shall not be used for circuits with system voltage over 480 volts.
   2. Liquid-tight Flexible Metal Conduit:
      a. Install liquid-tight flexible metal conduit for connections to rotating, vibrating, moving or movable equipment, including dry-type transformers. Install internal ground wire on flexible conduit with grounding bushings.
   3. Flexible Metal Conduit:
      a. Where required, install standard flexible steel metal conduit (not liquid-tight) with internal ground wire, in spaces above ceilings.
      b. Install flexible conduit connection such that vibrations are not transmitted to adjoining conduit or building structure. Maximum length shall be four (4) feet, minimum two (2) feet; minimum size shall be ½-inch.
      c. Communication flexible conduit size in walls shall be minimum 1-inch.
      d. Flexible conduit for lay-in fixtures may be 3/8-inch factory whip assemblies (6 feet maximum).
      e. Flexible conduit for receptacles in office applications can be used in the walls as long as the flexible conduit length does not exceed 12 feet and the flexible conduit run is not horizontal. Where fished in existing walls, the length shall not exceed 12 feet.
   4. PVC Conduit:
      a. Utilize PVC conduit for underground outdoor installations, minimum size 1-inch. All PVC conduit runs shall have PVC coated rigid steel stub outs from the ground, including the last 90 degree bend.
      b. All underground PVC conduit shall be installed in concrete with 12-inch x 12-inch x 3-inch concrete markers at every 100 feet and at every turn in direction.
      c. All underground conduits shall be installed with “DANGER – BURIED ELECTRICAL CONDUIT” yellow flagging tape 6-inches above conduit. Continuous above conduit.

F. Multiple Conduit Installation:
1. Install two (2) or more conduits parallel to or at 90 degrees to the structure. Support on metal framing constructed trapeze hangers supported on minimum 3/8-inch diameter all-thread rod attached to the structure with coupling nuts and expansion bolts or beam clamps. Conduit straps or other devices specifically designed for the purpose shall be used to secure conduits to the metal framing. Conduits shall only be installed on the top surface of the metal framing. Wire ties and hanger wires are not permitted. Hanger rods shall not extend more then 1-inch past trapeze hanger.

2. Where parallel conduits are strapped, fastened or anchored, the devices used shall be of the same type and installed on the same plane whether vertical or horizontal.

3. Conduit hangers from drop rod (like Caddy B18 Series) are acceptable only upon prior written approval from the Owner.

G. Single Conduit Installation:
1. Install single conduits parallel to or at 90 degrees to the structure and suspended from the structure on all thread rods (1/4-inch minimum) or clamped and/or clipped to the structure with manufactured clamps/clips. When single conduits are suspended from all thread rods, conduit clamps with bolts and nuts shall be used. Through partition wall penetration shall not be construed as a means of conduit support. Wire ties and hanger wires are not permitted. Single conduits may be secured as follows:
   a. Wood screws on wood.
   b. Toggle bolts on hollow masonry.
   c. Bolts and expansion anchors in concrete or brick.
   d. Machine screws, threaded rods and clamps on steel.
   e. Conduit clips on steel joists.
   f. Plastic anchors are not allowed.
   g. Conduit hangers from drop rod (like Caddy B18 Series) are acceptable only upon prior written approval from the Owner.

H. Fittings shall be approved for grounding purposes or shall be jumpered with a copper grounding conductor of appropriate ampacity. Leave termination of such jumpers exposed. Conduit and wireway systems shall not serve as branch circuit grounding conductors.

I. Install underground conduits with sealing glands equal to OZ Type FSK exterior to the conduit and OZ type CSB, or equal internally at the point where conduits enter the building to prevent water seepage into the building.

J. Install expansion fittings in metal conduit as follows:
1. Conduit Crossing Building Expansion Joints:
   a. EMT all sizes.
   b. Rigid Galvanized Steel (RGS) all sizes.
2. Conduits entering environmental rooms and other locations subject to thermal expansion and as required by NEC.
3. Provide conduit expansion fitting with an integral bonding braid, as in Crouse-Hinds Type XC.
4. Expansion fittings are not required where offsets, expansion loops, or flexible conduit are placed in conduit runs.

K. Install conduit concealed in walls, partitions and above ceilings. Install exposed in overhead conduit (at structure) of mechanical rooms and in other similar rooms where ceilings are not provided.

L. Avoid moisture traps where possible; where unavoidable, provide junction box with drain fitting at conduit low point.

M. Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.

N. Install pull wires in empty conduits. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Jetline 232 or equal by Greenlee. Leave at least 12 inches of slack at each end of pull wire.

O. Cap ends of spare conduits and extend into space above accessible ceiling a minimum of 18 inches. Label conduit as spare.

P. Do not daisy chain conduit installations in or on walls, provide a single conduit wall drop per device.
Q. Install conduits outside of building lines at a minimum depth of 30 inches below finished grade. Maintain twelve inches earth or two inches concrete separation between electrical conduits and other services or utilities underground. Encase all plastic service entrance conduits with concrete unless otherwise specifically detailed or noted on the drawings.

R. Ducts in concrete encased ductbanks shall be independently supported by interlocking module spacers by Formex or equal. Spacers shall provide 3 inches separation between adjacent ducts. Spacers shall be installed at 6 feet maximum intervals.

S. Ducts in concrete encased ductbanks shall be terminated in manholes, pull boxes, and vaults with interlocking terminators. A watertight tapered plug shall be furnished and installed in unused duct openings. Where terminators are installed in new work, they shall be poured-in-place.

3.3 INSTALLATION - WIREWAYS AND TERMINAL BOXES

A. Bolt wireways and terminal boxes to steel channels fastened to the wall or in self-supporting structure. Install level.

B. Gasket each joint in oil-tight wireway.

C. Mount rain-tight wireway in horizontal position only.

3.4 INSTALLATION - BOXES

A. Provide electrical boxes as shown on Drawings, and as required for wire pulling, equipment connection, and code compliance. Electrical box locations shown on Drawings are approximate unless dimensioned. Verify location of outlets prior to rough in. Locate and install boxes to allow access and clearances per NEC.

B. J-boxes shall be provided for branch circuits in excess of 100 feet.

C. Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, fixture studs, cable clamps, and metal strap for supporting outlet boxes. Accessories shall be compatible with outlet boxes being used and shall meet requirements of individual situations.

D. Do not install boxes back-to-back in walls. Provide minimum 6-inch separation in non-fire-rated walls. Provide minimum 24-inch horizontal separation in acoustic-rated walls.

E. Membrane penetration of minimum 1-hour, up to maximum 2-hour fire rating walls and partitions by recessed steel electrical boxes that do not exceed 16 square inches in area are permitted, provided the aggregate area of the openings does not exceed 100 square inches in any 100 square feet of wall area. The annular space between the wall membrane and the box shall not exceed 1/8 inch. Such boxes on opposite sides of the wall or partition shall be either separated by a horizontal distance of not less than 24 inches or separated by protecting both boxes by listed putty pads or other listed materials and methods.

F. Secure boxes rigidly to the substrate upon which they are being mounted, or solidly imbed boxes in concrete or masonry. Boxes shall not be permitted to move laterally. Boxes shall be secured between two studs. Boxes connected to one stud are not permitted.

G. Provide knockout plugs for unused openings.

H. Use multiple-gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.

I. Install boxes in walls without damaging wall insulation.

J. Outlet boxes in plaster partitions shall be “shallow-type” set flush in wall so there is at least 5/8-inch plaster covering back of box.

K. Switch boxes shall not be used as junction boxes.

L. Coordinate outlet heights with Architectural Drawings, millwork details, casework details and equipment installation. Where discrepancies occur, ask for an interpretation from the Architect/Engineer and Owner.

M. In inaccessible ceiling areas, position outlets and junction boxes within 6 inches of recessed luminaires, to be accessible through luminaire ceiling opening.
N. Outlet boxes supporting fixtures shall be securely anchored in place in an approved manner. Support outlet boxes and fixtures in acoustic ceiling areas from building structures with separate supports, not from acoustic ceiling or ceiling tile wire. Lighting fixture outlets shall be coordinated with mechanical and architectural equipment and elements to eliminate conflicts and to provide a workable neat installation.

O. Locate pull boxes and junction boxes above accessible ceilings or in unfinished areas.

P. Support pull and junction boxes independent of conduit. Combination box/conduit hangers from drop rod (like Caddy B18 Series) are acceptable only upon prior written approval from the Owner.

Q. Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations. Set floor boxes level, and adjust floor box flush with finish flooring material.

3.5 INSTALLATION - SURFACE METAL RACEWAYS

A. All raceway systems shall be installed complete, including insulating bushings and inserts where required by manufacturer’s installation sheets. All unused raceway openings shall be closed.

B. Install raceways above ceilings, exposed, on walls and casework parallel to or at right angles to structure and casework. Securely support raceway at intervals not exceeding 10 feet or in accordance with manufacturer’s recommendations.

C. The number of conductors installed in any raceway shall not be greater than the number for which the raceway is approved.

D. Maintain grounding continuity between raceway components to provide a continuous grounding path by means of separate insulated code-size grounding conductors.
   1. Each equipment grounding conductor in a conduit homerun entering the raceway shall be connected to the ground terminals of the receptacles.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES
   A. Items for identification of electrical products installed under Divisions 26 and 28.

1.2 SUBMITTALS
   A. Submit product data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
   A. W.H. Brady Co.
   B. Carlton Industries, Inc.
   C. Seton Nameplate Co.

2.2 MATERIALS
   A. Nameplates: Provide engraved three-layer laminated plastic nameplates with white letters on a black background.
   B. Wire and Cable Markers: Provide vinyl cloth markers with split sleeve or tubing type, except in manholes provide stainless steel with plastic ties.

PART 3 - EXECUTION

3.1 INSTALLATION
   A. Degrease and clean surfaces to receive nameplates.
   B. Install nameplates parallel to equipment lines.
   C. Embossed tape will not be acceptable.

3.2 WIRE AND CABLE LABELING
   A. Provide wire markers on each conductor in splice boxes, pull boxes, and at first load connection on homerun. Identify with 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.
   B. Identify branch circuit or feeder number for power and lighting circuits on cover of pull and junction boxes with indelible marker.

3.3 EQUIPMENT LABELING
   A. Provide nameplates to identify all electrical distribution and control equipment.
B. Engraved, Laminated Plastic Nameplates: 1/4-inch letters, equipment designation; 1/8-inch letters, source circuit number. Provide for:
   1. Enclosed switches, starters, circuit breakers and contactors. Provide neatly typed label inside each motor starter enclosure door identifying motor served, nameplate horsepower, full load amperes, design letter, service factor, and voltage/phase rating. Provide phenolic nameplate on cover exterior to indicate motor served.
C. Identify junction boxes by circuit number with legible permanent ink marker.
D. 

END OF SECTION
SECTION 26 05 73
PROTECTIVE RELAY AND DEVICE COORDINATION

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. Provide a complete short-circuit study and protective relay and device coordination study for the normal.
B. This work shall be performed by a registered Professional Engineer.

1.3 REFERENCE STANDARDS
A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within all references.

1.4 SUBMITTALS
A. Submit short-circuit study, phase and neutral current curves plotted on log-log paper with the proposed settings indicated.
B. The submittal shall include one line diagrams complete with conductor sizes and lengths of conductor.
C. The submittal shall include material sample of Arc Flash warning label proposed for the project.

PART 2 - PRODUCTS

2.1 ARC FLASH HAZARD WARNING LABELS
A. Electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized shall be field marked to warn qualified persons of potential electric arc flash hazards. The warning labels shall be located so as to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.
B. Arc Flash hazard warning signs and labels shall display the following information, but not limited to,
   1. Warning of “DANGER” with white letter on red background.
   2. Warning of "Arc Flash Hazard and Shock Hazard" in black.
   3. Two yellow triangular symbols representing the arc flash hazard and shock hazard respectively.
   4. Arc flash hazard risk category.
   5. Arc flash protection boundary.
   6. Arc flash incident energy level at 18 inches, in the unit of cal/cm².
7. Warning of “Appropriate Personal Protective Equipment required for both Arc-Flash and Shock Hazards: Safety Glasses, Class XX Voltage Gloves, Voltage Rated Tools, Non-melting, flammable clothing”.

8. Warning of “Shock Hazard”:
   a. xxx Vac – Shock Hazard with covers/doors open
   b. x’ – x” - Limited Approach Boundary
   c. x’ – x” - Restricted Approach Boundary
   d. x’ – x” - Prohibited Approach Boundary

9. The label shall display appropriate electrical equipment designation.

C. The warning labels shall not be smaller than 3-inch X 3-inch.

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 installation shall be in accordance with manufacturer’s published recommendations.

C. Normal Electrical Distribution System: The normal distribution system shall be coordinated from the service entrance main breakers through the feeder circuit breakers on the 480-volt switchgear.

D. Submit report to Engineer for review. Based upon the Engineer’s and CenterPoint Company’s review, different relay settings may be required pending this review. Comments shall be incorporated into a revised coordination package. All relays and trip settings shall be adjusted in accordance with the approved shop drawings.

E. The final Short-Circuit/Coordination Study/Arc Flash Hazard analysis, in the form of hard copy and electronic copy in SKM format, shall be submitted to the Owner. The electronic copy of Short-Circuit/Coordination Study/Arc Flash Hazard Analysis shall be demonstrated and validated to the Owner, on Contractor’s computer where SKM software is installed.

F. Arc flash hazard warning labels shall be factory affixed to electrical distribution equipment, in compliance with NFPA 70E, by the equipment manufacturer.

END OF SECTION
SECTION 26 22 13
DRY-TYPE TRANSFORMERS

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. This Section specifies the furnishing and installation of dry-type transformers with 600 volt and below primary and rated 500 kVA and smaller. All K-factor transformers are indicated on the Drawings as K-factor.

1.3 REFERENCE STANDARDS
A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:
   1. ANSI/NEMA ST 20 - Dry-Type Transformers for General Applications.
   2. ANSI/UL 506 - Specialty Transformers.

1.4 SUBMITTALS
A. Product Data:
   1. Provide product data on each transformer, vibration isolators, and accessories. Include the following minimum information:
      a. Manufacturer.
      b. Rated kVA, number of phases and frequency.
      c. Primary voltage and connections.
      d. Indicate K-Factor where applicable.
      e. Secondary voltage and connections.
      f. Number and percent taps.
      g. Outline dimensions.
      h. Total weight of unit.

1.5 DELIVERY, STORAGE AND HANDLING
A. Store units in a clean, dry space, protected from weather.
B. Units shall not be used as work surfaces, scaffolds, or ladders.
C. Handle units carefully to avoid damage to material components, enclosure, and finish. Use only lifting eyes and brackets provided for that purpose. Damaged transformers shall be rejected and shall not be installed.

PART 2 - PRODUCTS

2.1 GENERAL
A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
2.2 MANUFACTURERS
A. Square D/Schneider
B. Eaton.

2.3 NON K FACTOR DRY-TYPE TRANSFORMERS
A. Required kVA, voltages, phases and winding configurations are indicated on the Drawings. Transformers must be rated for 60-hertz operation, self-cooled NEMA Class AA capable of operating at 100 percent load continuously at an ambient temperature of 40 degrees C.
B. Coil windings: Copper wire (bar stock. Aluminum foil windings are not acceptable.
C. Taps: Furnish transformers with full load rated taps in the primary winding as follows:

<table>
<thead>
<tr>
<th>kVA Rating</th>
<th>Taps</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-15 kVA, single phase; 9-15 kVA, three phase</td>
<td>Two (2) percent taps below normal rated voltage.</td>
</tr>
<tr>
<td>25-100 kVA single phase; 30-300 kVA, three phase</td>
<td>Six (6) 2½ percent taps, four (4) below normal and two (2) above normal rated voltage.</td>
</tr>
<tr>
<td>167-250 kVA, single phase; 500 kVA, three phase</td>
<td>Four (4) 2½ percent taps, two (2) below and two (2) above rated voltage.</td>
</tr>
</tbody>
</table>

2.4 NON-LINEAR (K-FACTOR) DRY-TYPE TRANSFORMERS
A. Required kVA, voltages, phases and winding configurations are indicated on the Drawings. Transformers must be rated for 60-hertz operation, self-cooled NEMA Class AA capable of operating at 100 percent load continuously at an ambient temperature of 40 degrees C.
B. Provide electrostatic winding shield with separate insulated grounding connection.
C. Provide neutral bar sized for 200 percent of secondary phase conductors.
D. Manufactured and tested in accordance with IEEE C57.12.91, UL 1561, and NEMA ST 20 at K factor rating of 13.

2.5 GENERAL
A. Provide a 220 degrees C insulation system for rated kVA and temperature rise as follows:

<table>
<thead>
<tr>
<th>kVA Rating</th>
<th>Rise (Degrees C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-10 kVA, single phase</td>
<td>115</td>
</tr>
<tr>
<td>15-167 kVA, single phase</td>
<td>150</td>
</tr>
<tr>
<td>3-30 kVA, three phase</td>
<td>115</td>
</tr>
<tr>
<td>45-500 kVA, three phase</td>
<td>150</td>
</tr>
</tbody>
</table>

B. Average sound levels must not exceed the following values as measured in accordance with NEMA ST 20-4.12.

<table>
<thead>
<tr>
<th>kVA</th>
<th>dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-9</td>
<td>40</td>
</tr>
<tr>
<td>10-50</td>
<td>45</td>
</tr>
<tr>
<td>51-150</td>
<td>50</td>
</tr>
<tr>
<td>151-300</td>
<td>55</td>
</tr>
<tr>
<td>301-500</td>
<td>60</td>
</tr>
</tbody>
</table>

C. Enclosure: Unless otherwise specified or indicated, install transformers in metal enclosures designed to provide air-cooling and to prevent accidental contact with live conductors.
D. Wiring Compartment: Locate the wiring compartment below the core and coil. Have the compartment cooled by air circulation or insulated from the core and coil with a suitable thermal barrier.
E. Grounding: Ground the core of the transformer to the enclosure with a flexible grounding conductor sized according to NEC requirements.
F. Mounting Brackets: Furnish mounting brackets, as required, for wall (15 kVA and less) or structure (75 kVA and less) mounting of transformers.

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 installation shall be in accordance with manufacturer's published recommendations.
C. Install transformers as indicated in accordance with the applicable requirements of the NEC and the National Electrical Contractor’s Association “Standard of Installation”.
D. Install floor-mounted transformers on concrete housekeeping pads with vibration isolating pads suitable for isolating the transformer noise from the building structure in accordance with Section 26 01 00, General Electrical Requirements. Maintain a minimum of six (6) inches free air space between enclosure and walls.
   1. For floor and trapeze transformer installations, use one pad type Korfund Elasto-Grip, waffle at each corner of the transformer, sized for load of 50 pounds per square inch.
   2. For wall hung transformer installations (15kVA and less), use spring type Korfund Series P. Provide sound pads at each corner of the transformer sized for ½ inch deflection. Securely anchor wall-mounting brackets to wall to provide adequate support.
E. Suspend transformers (75kVA and less) from structure by means of trapeze hangers constructed of ½ inch galvanized all-thread rods and metal framing channels. All-thread coupling shall not be used on hanger rod shorter than 10 feet. The quantity of all-thread coupling, where used, shall not exceed more than one in a 10-foot section. All-thread coupling shall be backed by a ½-inch nut, which is tightened, at each end of the coupling. Make double-nut connections between rods and channels. Locate transformers to provide adequate ventilation and accessibility.
F. Check for damage and tighten connections prior to energizing transformer.
G. Set transformer plumb and level.
H. Verify removal of coil shipping anchor bolts before transformer is energized.

3.2 TESTING

A. Tap Setting:
   1. Select the appropriate tap setting on transformer so that the actual secondary voltage is + 1/2 of a tap span at full load.
   2. Record the transformer serial number, kVA rating, selected tap setting and secondary voltage readings.
   3. Submit three (3) copies of the record to the Owner's representative.
B. Conduit Connections:
   1. Attach incoming and outgoing conduits to the transformer enclosure with 48 inch long flexible metal conduit.
   2. Run a bonding jumper, sized per NEC Article 250, on outside of flexible conduit.
C. Cable Connections:
   1. Make transformer cable connections with compression-type lugs suitable for termination of 75 degrees C rated conductors.
   2. Position lugs so that field connections and wiring will not be exposed to temperature above 75 degrees C.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary
      Conditions and Division 01 Specification Sections, apply to this Section.
   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. This Section specifies the requirements for all panelboards including electronic grade
      panelboards.

1.3 REFERENCE STANDARDS
   A. The latest published edition of a reference shall be applicable to this Project unless identified
      by a specific edition date.
   B. All reference amendments adopted prior to the effective date of this Contract shall be
      applicable to this Project.
   C. All materials, installation and workmanship shall comply with the applicable requirements
      and standards addressed within the following references:
      1. NEMA AB 1 – Molded-Case Circuit Breakers, Molded Case Switches, and Circuit-
         Breaker Enclosures.
      2. NEMA PB 1 - Panelboards.
      3. NEMA PB 1.1 – General Instructions for Proper Installation, Operation and
         Maintenance of Panelboards Rated 600 Volts or Less.
      5. W-C-375B – Circuit Breakers, Molded Case; Branch Circuit and Service.
      7. NFPA 75 – Protection of Information Technology Equipment.
      9. Underwriters Laboratories UL 50 - Enclosures for Electrical Equipment, Non-
         Environmental Considerations.
     10. UL 67 – Panelboards.
     11. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker
         Enclosures.
     12. UL 943 - Ground-Fault Circuit-Interrupters.
     13. UL 1283 – Electromagnetic Interference Filters.
     14. UL 1449 - Surge Protective Devices.
     15. The specified Electronic Grade Panelboards (EGP) shall be designed, manufactured,
         tested, and installed in compliance with the following standards, in additional to
         requirements listed above:
         a. American National Standards Institute and The Institute of Electrical and
            Electronics Engineers ANSI/IEEE C62.41 - Guide for Surge Voltages in Low-Voltage
            AC Power Circuits.
         b. ANSI/IEEE C62.45 - Guide on Surge Testing for Equipment Connected to Low-
            Voltage AC Power Circuits.
         c. Federal Information Processing Standards Publication 94 - Field Grounding and
            Shielding Application.
16. The EGP shall be UL 1449 listed as a Transient Voltage Surge Suppressor, and UL 67 listed as a Panelboard. Surge protective device shall be both UL 67 listed and UL 1449 listed. The panel mounted suppression/filter system shall be UL 1449 listed as a Transient Voltage Surge Suppression System.

1.4 SUBMITTALS

A. Product Data:
   1. Submit manufacturer’s product data for panelboards and circuit breakers.

B. Record Documents:
   1. Submit dimensioned Drawings showing size, circuit breaker and equipment arrangement and ratings, including but not limited to, voltage, single or three phase, main bus ampacity, circuit breaker short circuit ampere rating.
   2. Equipment arrangement must include panelboard schedules. Panelboard schedules must be identical to the schedules in the project documents unless there is a technical reason for a deviation. Reasons for any deviation shall be included in the Submittal.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver panelboards in factory-fabricated water-resistant wrapping.
B. Handle panelboards carefully to avoid damage to material components, enclosure and finish.
C. Store in a clean, dry space and protected from the weather.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

2.2 MANUFACTURERS

A. Panelboards:
   1. Square D Company.
   2. Cutler Hammer/Eaton.

B. Electronic Grade Panelboards:

2.3 PANELBOARD CONSTRUCTION

A. Provide deadfront circuit breaker type panelboards as scheduled.
B. Enclosure shall be NEMA Type 1 unless otherwise indicated on the Contract Documents.
C. Provide cabinet front with full-height hinged door. Cabinet front shall be cleaned and finished with ANSI 49 or ANSI 61 gray enamel over a rust-inhibiting phosphatized coating. One door over the interior and an additional hinged dead front cover over interior and wireway (door-in-door). Full-height front cover hinged to box with concealed trim clamps. Provide flush door locks.
D. Panelboard boxes (cans) shall be galvanized steel with all cut edges galvanized. Boxes shall not have pre-punched knockouts. All conduit knockouts shall be made in the field.
E. Bus shall be tin-plated copper and braced for the maximum available fault current. Minimum bus ampacity shall be 100 amperes.
F. Circuit breaker phase connector straps that connect the main bus to individual circuit breakers shall be tin-plated copper.
G. Provide a 1 inch x ⅛ inch tin-plated copper ground bus in all panelboards. The ground bus shall be drilled to accept lugs for all grounding conductors. Mount ground bus on brackets to allow easy installation of bolts, nuts and lockwashers used to attach ground lugs.
H. Provide a tin-plated copper neutral bus with the same ampacity rating as the phase bus. Neutral bus shall be isolated from the ground bus.
I. All lugs for phase, neutral and ground buses shall be copper or tin-plated copper.
J. Provide compression connectors where conductors terminate directly to bus. (MLO panels).
K. Panelboard electrical ratings and configurations are indicated in the Contract Documents.

L. Circuit directory shall be typewritten and mounted behind clear, heat-resistant plastic in a metal frame, tack welded on the inside of each panel door. List the minimum circuit breaker ampere interrupting capacity on the circuit directory. List minimum panel required interrupting capacity.

M. Load center type panelboards are not acceptable. Panelboards shall be full bussed, entire length of panel; 100 ampere or higher panelboard minimum 42-circuits unless noted otherwise.

2.4 SWITCHING AND OVERCURRENT PROTECTIVE DEVICES

A. Provide molded case circuit breakers of manufacturer’s standard industrial construction, with integral inverse time delay thermal and instantaneous trip. Provide bolt-on circuit breakers for 208Y/120V, 120/240V panels and 480Y/277V panels.

B. Circuit breakers shall be 125 VDC/240 AC rated for nominal 208Y/120V panels and 480Y/277V rated for nominal 480Y/277V panels. Minimum interrupting ratings shall be 10,000 amperes for 120/208V circuits and 14,000 amperes for 277/480V circuits, unless higher rating noted on the Contract Documents.

C. Breakers 225 ampere through 400 ampere shall have continuously adjustable magnetic pick-ups of approximately five to ten times trip rating.

D. Multi-pole breakers shall be two or three pole as specified. Handle ties are not permitted.

E. Circuit breaker interrupting rating shall be greater than the available short circuit current listed for the panelboard in which the circuit breaker is installed.

F. Panels shall be fully rated. All overcurrent devices shall be capable of interrupting the available fault current.

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 installation shall be in accordance with manufacturer’s published recommendations.

C. Anchor enclosures firmly to metal framing (Unistrut). Metal framing shall be structurally secured to walls and structural surfaces, ensuring that they are permanently and mechanically secured.

D. At the completion of the electrical system, check each phase of all panels under full load and arrange so that all phases shall carry the same load as near as possible.

E. Stub 5 (five) empty 3/4 inch conduits to an accessible location above the ceiling out of each recessed panelboard.

F. Install panelboards such that the center of the circuit breaker in the highest position will not be more than 6-1/2 feet above the floor.

G. Temporary Doors:
   1. Protect panelboard cabinets by a temporary door until the panelboard is energized.
   2. Temporary doors shall be ¼ inch thick plywood or equivalent rigid material.
   3. Temporary doors shall be installed when the cabinet is installed and shall remain closed at all times except when work is being performed inside the panelboard.

H. Permanent Doors and Trim:
   1. Install permanent doors and trim immediately before panelboards are energized.
   2. Maintain permanent doors and trim in factory condition after installation.
   3. Doors shall remain closed at all times except when the panelboard is de-energized and work is taking place within the panelboard.

I. Cabinets:
   1. Maintain cabinet interiors clean at all times.
   2. Cabinet exteriors shall be maintained free of mud, spray-on insulation, paint spray and all substances not placed on the exterior surface by the panelboard manufacturer.

J. Nameplates:
   1. Label each panelboard with a black laminated rigid phenolic nameplate with white core, minimum 3/16 inch high engraved letters.
2. Identify panelboard name, voltage, amperage rating with main lugs only or main circuit breaker, and location of main feed.
   a. K. Panel cabinets shall not be used as raceways or pull boxes for adjacent equipment. Panel cabinets shall not contain wire splices. Panel wiring shall be installed in a neat and workmanlike manner with wire conforming to the contours of the cabinet. Wire bundles shall be wire tied and installed in a manner to protect wire insulation from cover screws and other sharp edges. All phase conductors shall be labeled with a circuit number, readily visible to the panelboard front without removing the dead front cover. All neutral conductors shall be labeled with the circuit number, which they are associated with, within three inches of their termination point.

END OF SECTION
SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
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. This Section specifies the requirements for wiring devices (wall switches, receptacles, device plate covers, wall dimmers).

1.3 REFERENCE STANDARDS
A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:
   1. NEMA WD 1 - General-Purpose Wiring Devices.
   2. NEMA WD 2 - Semiconductor Dimmers for Incandescent Lamps.
   3. NEMA WD 5 - Specific-Purpose wiring Devices.
   4. Americans with Disabilities Act (ADA).
   5. ANSI/UL 20 - General Use Snap Switches.
   6. ANSI/UL 498 - Attachment Plugs and Receptacles.
   7. ANSI/UL 943 - Ground Fault Circuit Interrupters.

1.4 SUBMITTALS
A. Product Data:
   1. Submit manufacturer's product data for all wiring devices and floor boxes.

PART 2 - PRODUCTS

2.1 GENERAL
A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
B. Provide factory fabricated wiring devices in the type and electrical rating for the service indicated. Where type and grade are not indicated provide proper selection to correspond with branch circuit wiring and overcurrent protection.
C. Attachment of wires to devices shall be by screw pressure under the head of binding screws. Arrangements depending on spring pressure or tension are not acceptable. All binding screws shall be brass or bronze.

2.2 MANUFACTURERS
A. Wall Dimmers:
   1. Lutron.
   2. Leviton.
   3. Pass & Seymour
B. Lighting Occupancy Sensors:
   1. The Watt Stopper.
   2. Hubbell.
   4. Other manufacturers as specifically approved in writing by Owner.

2.3 WALL SWITCHES
A. Type: Quiet type, back and side wired switches as specified herein.
B. Rating: 20 amperes, 120/277 volts.
D. Finish/Color: As selected by Architect. Provide sample for approval.

2.4 RECEPTACLES
A. Type: Back and side wired receptacles, as specified herein.
B. Rating: Scheduled on Drawings.
D. Finish: As selected by Architect. Provide sample for approval.
E. All receptacles within 15 feet of a water source shall be a Class A GFCl type.
F. Weatherproof receptacles shall be mounted in a cast steel box with gasketed, weatherproof device plate.
G. Heat trace receptacles shall be Arrow-Hart #5262CRGRY with Crouse Hinds #WLRD-1 cover. Install round plug on cord supplied with heat trace to match weatherproof bushing on receptacle cover for watertight installation.

2.5 DEVICE PLATES
A. Finished Office Areas: Nylon in color as selected by Architect.
B. Exposed Boxes in Dry Interior Spaces:
   1. Manufacture plates of heavy cadmium-plated sheet steel.
   2. Edges of plates must be flush with edges of boxes.
C. Other Areas:
   1. Use weatherproof device plates.
   2. Provide cast plates with gasketed spring door covers for protection of device.
D. For outlets and switches, provide labeled nameplates listing power source and circuit number. Example: P10 for panel "P" circuit “10”. Label to be tape type black letters on white for normal power.
E. Covers for outlets outdoors shall meet the requirements of latest NEC.

2.6 DEVICE COLOR
A. All switches shall be color as selected by architect.
B. Normal power receptacles shall be color as selected by architect.
C. Isolated ground receptacles shall be orange.

2.7 WALL DIMMERS
A. Wall dimmers shall be linear slide type equal to Lutron Nova Series.
B. Dimmers shall be 600 watts minimum, incandescent, larger size as required to accommodate greater connected loads.

2.8 LIGHT OCCUPANCY SENSORS
A. Lighting occupancy sensors shall be installed as a functioning system per the Contract Documents and manufacturer’s installation instructions.
B. Verify placement and proper application of occupancy sensors per manufacturer recommendations prior to Substantial Completion.
2.9 TELECOMMUNICATION OUTLETS
A. Telecommunication outlets, boxes, sleeves and conduit are part of this Contract.
B. Provide outlet boxes and 3/4-inch conduit with connector and bushing to accessible location above the ceiling.
C. Provide a pull string in each conduit and tie off pull string above ceiling.
D. For floor outlets, provide 1-inch conduit to accessible location above the ceiling on the floor served by the outlet.

PART 3 - EXECUTION

3.1 PREPARATION
A. Contractor must examine the areas and conditions under which wiring devices are to be installed and notify the Owner’s Project Manager in writing of conditions detrimental to the proper and timely completion of the Work.
B. Inspect devices for physical damage.
C. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.2 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 manufacturer's published recommendations.
C. Wall switch and receptacle ground wiring shall terminate at the wiring device with an insulated tin-plated copper spade compression terminal. Select a spade terminal compatible with the wiring devices supplied so that device screw terminals can be torqued to the wiring device manufacturer's recommendations.
D. Wall receptacles shall be installed with the ground pinhole in the up position, unless instructed otherwise by the Owner.
E. The approximate location of switches and receptacles are indicated on the Drawings. These Drawings, however, may not give complete and accurate information in regard to locations of such items. Determine exact locations by reference to the architectural Drawings and by actual measurements during construction of the building before rough-in, subject to the approval of the Owner’s Project Manager.
F. Install wall switches 48 inches above finished floor, OFF position down.
G. Install wall dimmers 48 inches above floor; derate ganged dimmers as instructed by manufacturer; do not use common neutral.
H. Where wainscot is near the 48 inch level, install device in the wall below the top edge of the wainscot and as near the 48 inch level as possible to provide the most pleasing appearance. Do not partially install devices in the wainscot and partially in the wall.
I. Where shown the strike side of doors, install switches and dimmers not less than 2 inches and not more than 12 inches from door trim, but in all cases as close to the 2 inch setback as possible.
J. Verify all doors swings before rough-in and locate switches and dimmers on strike side of door wherever possible.
K. Position the center of convenience, telephone, computer and TV outlets 18 inches above floor or 6inches horizontally above countertops unless otherwise noted. Coordinate with equipment and architectural Drawings. Install outlets vertically on walls and horizontally above countertops.
L. Install specific-use receptacles at heights shown on Drawings.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
   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. This Section specifies the requirements for 600V fuses rated 0-600 amps and 601-6000 amps.

1.3 REFERENCE STANDARDS
   A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
   B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
   C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:
      1. ANSI/UL 198.4 - Class R Fuses.
      2. ANSI/UL 198.3 - High Interrupting-Capacity Fuses, Current Limiting Types, Class L.

1.4 SUBMITTALS
   A. Product Data:
      1. Submit manufacturer’s data on fuses.

1.5 EXTRA MATERIALS
   A. Maintenance Stock, Fuses:
      1. Furnish two set of spare fuses (3 fuses) of each size and type used on the Project in a keyed lockable fuse cabinet (keyed to Owner’s master electrical key).
      2. Fuse cabinet to be mounted in main electrical room of the building as designated by Owner.

PART 2 - PRODUCTS

2.1 GENERAL
   A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

2.2 MANUFACTURERS
   A. Bussman.
   B. Gould Shawmut.
   C. Littlefuse, Inc.

2.3 MATERIAL AND EQUIPMENT
   A. Furnish fuses in accordance with the following:
      1. Motors and Transformers, 0 to 600 amp:
a. 250 volt - Buss LPN-RK, UL Class RK1.
b. 600 volt - Buss LPS-RK, UL Class RK1.

2. Lighting Loads, 0 to 600 amp:
   a. 250 volt - Buss LPN-RK, UL Class RK1.
   b. 600 volt - Buss LPS-RK, UL Class RK1.

3. All applications, 601 to 6000 amp: 600 volt - Buss KRP-C, UL Class L.

   B. Size fuses serving motor loads actually installed as specifically recommended by motor or equipment manufacturer or 125 percent of motor nameplate rating, or the next standard.

   C. Interrupting Rating: 200,000 RMS amps.

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 installation shall be in accordance with manufacturer's published recommendations.

   C. Install fuses so label is in an upright, readable position.

   D. Check all fuse clip fasteners for alignment and tightness in accordance with the manufacturers recommendations.

   E. Fuses for HVAC equipment shall be provided in accordance with equipment manufacturer's recommendations.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Shop 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. This Section specifies the requirements for disconnect switches, fusible and nonfusible.

1.3 REFERENCE STANDARDS
   A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
   B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
   C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:
      1. Federal Spec. W-S-865 - Switch, Box (Enclosed), Surface Mounted.
      2. NEMA KS 1 - Enclosed Switches.

1.4 SUBMITTALS
   A. Submit manufacturer’s product data.
   B. Submit dimensioned Shop Drawings and equipment ratings for voltage, capacity, horsepower, and short circuit.

1.5 DELIVERY, STORAGE AND HANDLING
   A. Deliver switches individually wrapped in factory-fabricated water-resistant type containers.
   B. Handle switches carefully to avoid damage to material components, enclosure and finish.
   C. Store switches in a clean, dry space protected from weather.

PART 2 - PRODUCTS

2.1 GENERAL
   A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

2.2 MANUFACTURERS
   A. General Electric Company.
   B. Square D Company.
   C. Cutler Hammer/Eaton.
   D. Siemens.
2.3 FABRICATED SWITCHES

A. Depending upon the service indicated, use 250 or 600 volt switches, single throw, fusible, or nonfusible, horsepower rated, heavy duty, with externally operable handle interlocked to prevent opening of front cover with switch in ON position. Handle designed for locking in “ON” or “OFF” position, in code-gage steel cabinets.

B. Provide defeater so that qualified personnel can open door while switch is in the closed position.

C. Use switches which have number of poles required, dependent upon phase serving equipment.

D. Switches shall be NEMA 1 Underwriters’ approved for duty shown. In wet locations, use NEMA 3R. Where exposed to weather in exterior applications, use NEMA Krylon, corrosion resistant type. NEMA 3R and NEMA Krylon switches shall have weatherproof threaded hubs for all conduit entries into switch.

E. Use fuse clips that are rejecting type to accept Class RK or L fuses.

F. Identify switches, as to equipment served, with engraved laminated phenolic name plates. Refer to Section 26 01 00 for nameplate information.

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 installation shall be in accordance with manufacturer's published recommendations.

C. Install safety or disconnect switches for all electrical equipment, in accordance with the applicable requirements of NEC and the National Electrical Contractors Association “Standard of Installation.”

D. For all equipment with motors larger than 1/8 horsepower, provide motor rated disconnect switches within sight of the motor.

E. Disconnect switches for such equipment shall be mounted independent of the unit to allow for maintenance access.

END OF SECTION
SECTION 26 28 20
ENCLOSED CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Shop 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. This Section specifies the requirements for molded-case and insulated-case circuit breakers in individual enclosures

1.3 REFERENCE STANDARDS
A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:
   1. Federal Spec. W-S-865 - Switch, Box (Enclosed), Surface Mounted.
   2. NEMA AB 1 Molded Case Circuit Breakers and Molded Case Switches.
   3. NETA ATS - Electrical Power Distribution Equipment and Systems

1.4 SUBMITTALS
A. Submit manufacturer’s product data.
B. Submit dimensioned Shop Drawings and equipment ratings for voltage, capacity, horsepower, and short circuit.

1.5 DELIVERY, STORAGE AND HANDLING
A. Deliver switches individually wrapped in factory-fabricated water-resistant type containers.
B. Handle switches carefully to avoid damage to material components, enclosure and finish.
C. Store switches in a clean, dry space protected from weather.

1.6 EXTRA MATERIALS
A. Supply three of each size and type of current limiters.

PART 2 - PRODUCTS

2.1 GENERAL
A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

2.2 MANUFACTURERS
A. General Electric Company.
B. Square D Company.
C. Cutler Hammer/Eaton.
2.3 MOLDED CASE CIRCUIT BREAKER

A. Enclosed, molded-case circuit breaker conforming to NEMA AB 1, suitable for use as service entrance equipment where so applied.

B. Service Conditions:
   1. Temperature: 100 degrees F.
   2. Altitude: 1000 feet.

C. Breakers 300 amp frame or less shall be manufacturer’s standard industrial construction, bolt-on type, integral inverse time delay thermal and instantaneous magnetic trip. Breakers 225 ampere through 400 ampere shall have continuously adjustable magnetic pick-ups of approximately five to ten times trip rating.

D. Breakers 400 ampere frame and above shall be equipped with solid-state trip complete with built-in current transformer, solid-state trip unit, Long Time, Short Time, Instantaneous, Ground Fault, Overcurrent Trip and flux transfer shunt trip.

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 installation shall be in accordance with manufacturer’s published recommendations.

C. Install safety switches for all electrical equipment, in accordance with the applicable requirements of NEC and the National Electrical Contractors Association “Standard of Installation.”

D. Enclosed Circuit Breakers shall be mounted independent of the equipment to allow for maintenance access.

E. Adjust trip settings so that circuit breakers coordinate with other overcurrent protective devices in circuit.

F. Adjust trip settings to provide adequate protection from overcurrent and fault currents.

END OF SECTION
SECTION 26 43 13
SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
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. These Specifications describe the requirements for an electrical surge protection system integrating both transient voltage surge suppression and electrical high frequency noise filtering for “High Exposure”, “Medium Exposure”, and “Low Exposure” locations as defined in ANSI/IEEE C62.41-1991.
B. SPD shall be integral to switchgear.

1.3 REFERENCE STANDARDS
A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:
   2. ANSI/IEEE C62.1 and C62.11.
   3. Canadian Standards; (CUL).
   7. Underwriters Laboratories (UL 1449 and 1283).
   8. Underwriters Laboratories (UL 489 and UL 198).
D. The unit shall be UL 1449 Listed and CUL Approved as a Surge Protective Devices and UL 1283 Listed as an Electromagnetic Interference Filter.

1.4 SUBMITTALS
A. Product Data:
   1. Provide data showing UL1449 product listing. Submit certified documentation of applicable Location Category Testing in full compliance with NEMA LS 1-1992, paragraphs 2.2.10 and 3.10.
B. Record Documents:
   1. Provide Drawings that show unit dimensions, weights, mounting provisions, connection details and layout diagram of the unit.
4. The unit shall include a Diagnostic Signature Card listing factory-established benchmark suppression voltage values for all modes of protection. The suppression voltage values shall be established during final production line testing utilizing the DTS-2 Diagnostic Test Set. This Diagnostic Signature Card shall provide space for subsequent field-testing allowing comparison of the initial factory benchmark testing with subsequent field-testing suppression voltage values.

C. Operation and Maintenance Data:
   1. Provide an equipment manual that details the installation, operation and maintenance instructions for the specified unit.
   2. Provide a list of customer-replaceable spare parts. All spare parts shall be quickly and easily field-replaceable.

1.5 WARRANTY
   A. The manufacturer shall provide a ten (10) year limited warranty from date of shipment against failure when installed in compliance with applicable national/local electrical codes and the manufacturer's installation, operation and maintenance instructions.
   B. Warranty shall commence after the Owner has accepted the testing results and taken possession of the equipment.

PART 2 - PRODUCTS

2.1 GENERAL
   A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

2.2 MANUFACTURERS
   A. Square D/Schneider
   B. Eaton

2.3 ENVIRONMENTAL REQUIREMENTS
   A. Storage Temperature: Storage temperature range: -40 degrees to +85 degrees C, (-40 degrees to +185 degrees F).
   B. Operating Temperature: Operating temperature range: -40 degrees to +60 degrees C, (-40 degrees to +140 degrees F).
   C. Relative Humidity: Reliable operation with 5 percent to 99 percent non-condensing relative humidity.
   D. Operating Altitude: Capable operation up to 13,000 feet above sea level.
   E. Audible Noise: The unit shall not generate any audible noise.
   F. Magnetic Fields: No appreciable magnetic fields shall be generated. Unit shall be capable of use in computer rooms without danger to data storage systems or devices.

2.4 ELECTRICAL REQUIREMENTS
   A. Unit Operating Voltage shall be as shown on Drawings.
   B. Maximum Continuous Operating Voltage (MCOV) shall be greater than 115 percent of nominal voltage.
   C. Operating Frequency: Operating frequency range shall be 47 to 63 Hz.
   D. Protection Modes: All protected modes are defined per NEMA LS 1-1992, paragraph 2.2.7. Following IEEE Standard 1100-1992, Section 9.11.2 recommendations, units shall provide protection in all modes. WYE configured system shall provide Line-to-Neutral, Line-to-Ground, Line-to-Line and Neutral-to-Ground protection. DELTA configured systems shall provide Line-to-Line protection. Line-to-Line and Line-to-Ground protection shall be provided for all corner grounded DELTA systems.
   E. Rated Single Pulse Surge Current Capacity: The rated single pulse surge current capacity, in amps, for each mode of protection of the unit shall be no less than as follows and in accordance with UL 1449:
      1. High Exposure TVSS Rated Single Pulse Surge Current Capacity:
F. Tested Single Pulse Surge Current Capacity: In compliance with NEMA LS 1-1992, paragraphs 2.2.7, 2.2.9 and 3.4.8.
   1. The test shall include an ANSI/IEEE C62.41-1991 Category C1 surge defined as a 1.2 X 50 μ sec, 6000V open circuit voltage waveform and an 8 X 20 μ sec, 3000A short circuit current waveform to benchmark the unit's suppression voltage, followed by a single pulse surge of maximum rated surge current (for units rated over 200,000A per mode, components or sub-assemblies are tested) magnitude with an approximated 8 X 20 μ sec waveform.
   2. To complete the test, another Category C1 surge shall be applied to verify the unit's survival. Survival is achieved if the suppression voltage measured from the two category C1 surges does not vary by more than 10 percent.

G. Minimum Repetitive Surge Current Capacity: Per ANSI/IEEE C62.41 and ANSI/IEEE C62.45-1992, all suppression filter systems shall be repetitive surge current capacity tested in every mode utilizing a 1.2 x 50 μ sec, 20 KV open circuit voltage, 8 x 20 μ sec, 10 KA short circuit current Category C3 bi-wave at one minute intervals without suffering either performance degradation or more than 10 percent deviation of clamping voltage at a specified surge current.
   1. High Exposure TVSS Repetitive Surge Current Capacity-Number of Impulses:
      | L-L | L-N | L-G | N-G |
      |-----|-----|-----|-----|
      | >12,000 | >12,000 | >12,000 | >12,000 |
   2. Medium Exposure TVSS Repetitive Surge Current Capacity-Number of Impulses:
      | L-L | L-N | L-G | N-G |
      |-----|-----|-----|-----|
      | >5,500 | >5,500 | >5,500 | >5,500 |
   3. Low Exposure TVSS Repetitive Surge Current Capacity-Number of Impulses:
      | L-L | L-N | L-G | N-G |
      |-----|-----|-----|-----|
      | >3,500 | >3,500 | >3,500 | >3,500 |

H. NEMA LS1-1992 Clamping (Let-Through) Voltage Data. Maximum clamping (Let Through) voltages for units with an integral fused disconnect are as follows:
   1. High Exposure TVSS With Fused Disconnect:
      | System Voltage | Mode | B3 Ringwave | B3/C1 | C3 |
      |----------------|------|-------------|-------|----|
      | 120/240        | L-N  | 350         | 425   | 750|
      | 120/208        | L-G  | 425         | 475   | 800|
      |                | N-G  | 325         | 450   | 725|
      |                | L-L  | 475         | 825   | 1225|
      | 277480         | L-N  | 575         | 875   | 1200|
### Medium Exposure TVSS With Fused Disconnect:

<table>
<thead>
<tr>
<th>System Voltage</th>
<th>Mode</th>
<th>B3 Ringwave</th>
<th>B3/C1</th>
<th>C3</th>
</tr>
</thead>
<tbody>
<tr>
<td>120/240</td>
<td>L-N</td>
<td>350</td>
<td>425</td>
<td>725</td>
</tr>
<tr>
<td>120/208</td>
<td>L-G</td>
<td>425</td>
<td>425</td>
<td>725</td>
</tr>
<tr>
<td></td>
<td>N-G</td>
<td>375</td>
<td>425</td>
<td>700</td>
</tr>
<tr>
<td></td>
<td>L-L</td>
<td>450</td>
<td>825</td>
<td>1150</td>
</tr>
<tr>
<td>277480</td>
<td>L-N</td>
<td>550</td>
<td>850</td>
<td>1150</td>
</tr>
<tr>
<td></td>
<td>L-G</td>
<td>875</td>
<td>850</td>
<td>1150</td>
</tr>
<tr>
<td></td>
<td>N-G</td>
<td>700</td>
<td>850</td>
<td>1150</td>
</tr>
<tr>
<td></td>
<td>L-L</td>
<td>725</td>
<td>1650</td>
<td>2100</td>
</tr>
</tbody>
</table>

### Low Exposure TVSS With Fused Disconnect:

<table>
<thead>
<tr>
<th>System Voltage</th>
<th>Mode</th>
<th>B3 Ringwave</th>
<th>B3/C1</th>
<th>C3</th>
</tr>
</thead>
<tbody>
<tr>
<td>120/240</td>
<td>L-N</td>
<td>300</td>
<td>400</td>
<td>550</td>
</tr>
<tr>
<td>120/208</td>
<td>L-G</td>
<td>400</td>
<td>400</td>
<td>600</td>
</tr>
<tr>
<td></td>
<td>N-G</td>
<td>325</td>
<td>475</td>
<td>800</td>
</tr>
<tr>
<td></td>
<td>L-L</td>
<td>425</td>
<td>725</td>
<td>900</td>
</tr>
<tr>
<td>277480</td>
<td>L-N</td>
<td>500</td>
<td>875</td>
<td>1050</td>
</tr>
<tr>
<td></td>
<td>L-G</td>
<td>825</td>
<td>825</td>
<td>1025</td>
</tr>
<tr>
<td></td>
<td>N-G</td>
<td>650</td>
<td>875</td>
<td>1200</td>
</tr>
<tr>
<td></td>
<td>L-L</td>
<td>700</td>
<td>1625</td>
<td>1825</td>
</tr>
</tbody>
</table>

I. UL1449 Ratings: All suppression filter system products are UL1449 rated and listed.
J. High Frequency Extended Range Power Filter: EMI-RFI noise rejection or attenuation values are in compliance with test and evaluation procedures outlined in NEMA LS-1-1992, paragraphs 2.2.11 and 3.11.
<table>
<thead>
<tr>
<th>Frequency</th>
<th>100 kHz</th>
<th>1 MHz</th>
<th>10 MHz</th>
<th>100 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Exposure TVSS</td>
<td>41</td>
<td>31</td>
<td>36</td>
<td>53</td>
</tr>
<tr>
<td>Medium Exposure TVSS</td>
<td>44</td>
<td>33</td>
<td>36</td>
<td>53</td>
</tr>
<tr>
<td>Low Exposure TVSS</td>
<td>50</td>
<td>37</td>
<td>38</td>
<td>53</td>
</tr>
</tbody>
</table>

1. Note: Standardized insertion loss data obtained utilizing MIL-STD-E220A 50 ohm insertion loss methodology.

K. The Suppression Filter System shall function in conjunction with other suppression filter devices of the same manufacturer via coordinated filters within the facility-wide suppression filter system that provide minimum noise attenuation as follows:

1. High, Medium, and Low Exposure TVSS:

<table>
<thead>
<tr>
<th>Frequency</th>
<th>100 kHz</th>
<th>1 MHz</th>
<th>10 MHz</th>
<th>100 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attenuation Frequency Insertion Loss (dB)</td>
<td>83</td>
<td>68</td>
<td>67</td>
<td>84</td>
</tr>
</tbody>
</table>

a. Note: Standardized insertion loss data obtained utilizing MIL-STD-E220A 50 ohm insertion loss methodology, based on a minimum of 100 ft. of #4 AWG conductor between the two devices.

L. Overcurrent Protection: The unit shall be installed with coordinated UL 489 or UL 198 listed or recognized overcurrent protection devices. Suppression filter systems that utilize fusing as overcurrent protection shall incorporate non-encapsulated, field-replaceable fuses.

2.5 HIGH PERFORMANCE SUPPRESSION SYSTEM

A. Units shall include an engineered solid-state high performance suppression system utilizing a predetermined number of selenium cells and arrays of non-linear voltage dependent metal oxide varistors with similar operating characteristics.

B. The suppression system components shall optimally share surge currents in a seamless, low-stress manner assuring maximum performance and proven reliability. The suppression system shall not utilize gas tubes, spark gaps, silicon avalanche diodes or other components which might short or crowbar the line, thus leading to interruption of normal power flow to or system upset of connected loads. The suppression system shall not incorporate non-field replaceable encapsulated fusing or any other components that may degrade performance or long-term reliability of the suppression system. Suppression system shall reduce transient levels and provide protection for sensitive electronics susceptible to catastrophic or long-term damage. Clamp voltages are specified herein.

C. The unit shall include a high frequency extended range power filter and shall be UL 1283 listed as an Electromagnetic Interference Filter. The filter shall reduce fast rise-time, high frequency, error-producing transients and electrical line noise to harmless levels, thus eliminating disturbances, which may lead to electronic system upset. The filter shall provide minimum noise attenuation values as specified herein.

D. All internal wiring associated with the suppression filter system and subject to surge currents shall utilize low-impedance copper bus bar. For internal wiring, minimum wire size is shown in table below. All internal connections associated with the suppression filter system and subject to surge currents shall be made with compression or mechanical solderless-type lugs and shall be bolted to the bus bars in order to reduce overall system impedance. No plug-in component modules, quick-disconnect terminals, non-field replaceable fusing or printed circuit boards shall be used in surge current-carrying paths.

1. High and Medium Exposure TVSS Minimum Wire Size:

   a. #2 AWG Copper.

2. Low Exposure TVSS Minimum Wire Size:
2.6 FIELD CONNECTIONS
A. The unit shall include mechanical or compression lugs for each phase, neutral and ground, if applicable. Recommended wire size range is as follows:

<table>
<thead>
<tr>
<th>Phase</th>
<th>Neutral</th>
<th>Ground</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Exposure TVSS:</td>
<td>#2-1/0 AWG Copper</td>
<td>#2-1/0 AWG Copper</td>
</tr>
<tr>
<td>Low and Medium Exposure TVSS:</td>
<td>#8-#2 AWG Copper</td>
<td>#8-#2 AWG Copper</td>
</tr>
</tbody>
</table>

2.7 UNIT STATUS INDICATORS
A. The unit shall include long-life, solid state, externally visible status indicators that monitor the on-line status of each phase of the unit.

2.8 INTEGRAL TEST POINT
A. The unit shall incorporate an integral test point allowing easy off-line diagnostic testing verifying the operational integrity of the unit's suppression filter system.
B. Field-testing shall permit proactive testing to ensure performance and long-term reliability.
C. Testing shall include injection of an impulse into the off-line suppression filter system to verify the suppression performance values established at final factory testing and recorded on the Diagnostic Signature Card.
D. Indicator lights monitoring fuse condition or power available which inform the user of failure after the fact do not meet the intent of this Specification.

2.9 ENCLOSURE
A. Standard unit shall be supplied in a NEMA 4 metallic enclosure.

2.10 FUSED DISCONNECT SWITCH
A. Units shall include an integral fused and safety interlocked disconnect switch with an externally mounted manual operator.
   1. The switch shall disconnect all ungrounded circuit conductors from the distribution system to enable testing and maintenance without interruption of power to the facility's distribution system.
   2. The switch shall be rated for 600 Vac.
   3. Each current-carrying ungrounded circuit conductor connected to the facility's distribution system shall be individually fused with 200,000 AIC rated class J fuses in order to provide maximum fault current protection.
B. Units shall include a battery-powered audible alarm that detects and provides notification of any single or multiple phase failure of the suppression filter system. The unit shall also include a status indicator for each phase that extinguishes to indicate a failure mode and an LED that flashes to indicate any alarm condition.
   1. The alarm shall have a silence switch and a test switch for ensuring positive function and shall have an alarm disable LED that illuminates when the alarm is disabled.
   2. The monitoring unit shall have an easily replaceable, commonly available battery for backup to ensure audible alarm function in the event of a total power failure.
   3. The unit shall have a battery backup monitor light, which shall illuminate when the battery requires replacement.
   4. To monitor on-line status, the monitoring package shall also include two sets of form C dry contacts (normally open or normally closed) to facilitate connection to a building management system.
   5. The contacts shall be normally open or normally closed and shall change state upon the failure of the suppression system or power loss in any combination of all three phases.
6. The unit for WYE distribution systems with a neutral shall include two (2) solid-state eight (8) digit liquid crystal displays that discriminate between and exhibit both common mode (L-G) and normal mode (L-N) disturbances.
7. The unit for DELTA distribution systems shall include one (1) solid state eight (8) digit liquid crystal display that exhibits normal mode (L-L) disturbances.
8. The Display Event Counters shall utilize self-contained lithium batteries with a nominal life of ten (10) years.
9. Reset function shall be secure and remotely located.

2.11 DIAGNOSTIC TEST SET
A. The Diagnostic Test Set shall be self-contained and portable and shall provide complete assurance of suppression capability without stressing the suppression system or posing detriment to continued operation.
B. Testing shall be achieved by injecting a high voltage low current transient to test the function of each mode of the suppression filter system.
C. Use of a low current transient shall ensure there is no damage or degradation to the suppression filter system.

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 installation shall be in accordance with manufacturer's published recommendations.
C. Connect unit to electrical system with 100 amp, 3-pole circuit breaker.

3.2 TESTING
A. Each unit shall be factory tested at the applicable MCOV to assure proper field operation.
B. Each unit shall be thoroughly factory tested before shipment. Testing of each unit shall include but shall not be limited to UL manufacturing and production-line tests, quality assurance checks, MCOV and clamping voltage verification tests.
C. Upon completion of installation, a factory-certified local service technician shall provide testing services. The following tests shall be performed:
   1. Voltage measurements from Line-to-Ground, Line-to-Neutral, Line-to-Line and Neutral-to-Ground (no neutral in DELTA configurations) at the time of the testing procedure.
   2. Impulse injection to verify the system suppression voltage tolerances for all suppression paths. Impulse testing shall be completed while the unit is off-line to isolate the unit from the distribution system.
D. Test results should be recorded and compared to factory benchmark test parameters supplied with each individual unit. A copy of the Start-up test results and the factory benchmark testing results shall be supplied to the Engineer and the Owner for confirmation of proper suppression filter system junction. In addition, the integrity of the neutral-ground bond should be verified through testing and visual inspection.

3.3 APPLICATION
A. The following matrix indicates types of transient voltage surge exposures based on the power distribution system. For actual TVSS installation locations, refer to the Drawings.
<table>
<thead>
<tr>
<th>Exposure Level</th>
<th>Service Entrances</th>
<th>Large Distribution Panels</th>
<th>Non-Service Entrance Distribution Panels</th>
<th>Heavy Equipment (UPS, Elevators)</th>
<th>Panels Feeding Variable Speed Drives</th>
<th>Branch Panels with Upstream Protection</th>
<th>Branch Panels with Sensitive Electronic Loading</th>
<th>Branch Panels Located Deep Within a Facility</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Exposure</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium Exposure</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Exposure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

END OF SECTION
SECTION 26 51 00
LIGHTING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary
   Conditions and Division 01 Specification Sections, apply to this Section.
B. 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. This Section specifies requirements for indoor and outdoor lighting fixtures, exit signs, lamps
   and ballasts.

1.3 REFERENCE STANDARDS
A. The latest published edition of a reference shall be applicable to this Project unless identified
   by a specific edition date.
B. All reference amendments adopted prior to the effective date of this Contract shall be
   applicable to this Project.
C. All materials, installation and workmanship shall comply with the applicable requirements and
   standards addressed within the following references:
   2. NFPA 101 – National Electrical Code
   3. NEMA WD1 - General-Purpose Wiring Devices.
      Residential Buildings.
   6. UL 924 – Standards for Emergency Lighting & Power Equipment

1.4 SUBMITTALS
A. Product Data:
   1. Submit a 3-ring binder with manufacturer's data on lighting fixtures in booklet form, with
      a separate sheet for each fixture, assembled by luminaire "type" in alphabetical order,
      with the proposed fixture and accessories clearly labeled. Ballast and lamp product
      data shall accompany fixture submittals.
B. Record Documents:
   1. Submit dimensioned drawings and performance data including coefficients of utilization,
      candela distribution, spacing to mounting height ratio, efficiency and visual comfort
      probability for each fixture, assembled by luminaire type in alphabetical order.

1.5 DELIVERY, STORAGE AND HANDLING
A. Deliver lighting fixtures individually wrapped in factory-fabricated fiberboard type containers.
   Parabolic louvers shall be shipped in thermally sealed polyethylene wrapper.
B. Handle lighting fixtures carefully to prevent breakage, denting and scoring the fixture finish.
   Do not install damaged lighting fixtures.
C. Store product in a clean, dry space protected from weather.
PART 2 - PRODUCTS

2.1 GENERAL
   A. All materials shall meet or exceed all applicable referenced standards, federal, state and local
      requirements, and conform to codes and ordinances of authorities having jurisdiction.
   B. Lighting fixtures and accessories shall comply with the design and functional requirements of
      the Project. Design characteristics shall be as noted in manufacturer's submittal data.
   C. Provide lighting fixtures of the size, type and rating as scheduled, complete with, but not limited
      to, lamps, lamp holders, reflectors, ballasts, and wiring.

2.2 MANUFACTURERS
   A. Lighting fixtures:
      1. As scheduled.

2.3 EMERGENCY EXIT SIGNS
   A. Provide exit signs with red LED illumination.
   B. Exit signs shall have covers that are composed of a black face and body, smooth red diffusion
      material, with 6 inch-high red letters on black background, directional arrows as indicated.
      Individual LED's shall not be visible through the diffusion material.
   C. Fixtures shall have minimum five (5) year warranty.
   D. Fixtures shall be UL924 and Energy Star compliant.
   E. Exit signs shall be rated for dual voltage; 120/277.

2.4 LED LIGHTING
   A. Shall meet DOE’s Energy Star or Design Light Consortium performance criteria.
   B. The luminaire manufacturer shall provide the manufacturer’s name of the LED being used in
      the luminaire.
   C. Shall be UL listed and be furnished complete with LED’s and power supplies.
   D. Shall be tested in accordance with LM-79-08 electrical and photometric measurements.
   E. The CCT shall be 3500K unless otherwise scheduled.
   F. Each luminaire shall carry a 3-year minimum product warranty covering failure of ALL electrical
      components.

2.5 LED POWER SUPPLIES
   A. LED power supplies shall operate LEDs within the current limit specification of the
      manufacturer.
   B. Shall operate from 60Hz input source with input power factor >90 percent and a minimum
      efficiency of 70 percent at full rated load to the driver.
   C. Shall have short circuit and overload protection.
   D. Shall have a Class A sound rating.
   E. Shall contain no PCBs.
   F. Power supply output shall be regulated to +/- 5 percent across published load range.

2.6 EMERGENCY CENTRAL BATTERY SYSTEM
   A. Manufacturers
1. Signtex Lighting, Inc: Series CBM
2. Engineer Approved Equals

B. System Description:
1. Signtex Series CBM Central Battery System shall provide control and battery backup power for a minimum of 90 minutes to all emergency fixtures connected to the system, including exit signs, emergency lights, and night lights. All emergency lighting fixtures shall be able to operate in normal ON mode when building AC power is available, from a 24VDC power supply.

C. Construction and Operation
1. The power supply is to be a UPS system per NEC 700.12 (c) with storage batteries, charging system, automatic transfer switch and self-test switch with an LED indicator, providing uninterrupted output at 24VDC for loads as specified for at least 90 minutes in emergency operation. The Push to Test Switch and Diagnostic Status Indicator allow immediate update on battery condition and charger performance.
2. Maximum battery charge time shall be 12 hrs.
3. The equipment shall include automatic self-testing/self-diagnostic systems as mandated by NFPA 101 (2012), Section 7.9.3 Periodic Testing of Emergency Lighting Equipment, Para 7.9.3.1.3 (1) for Computer-based, Self-Testing/Self-Diagnostic battery-operated emergency lighting equipment.
4. The system shall be capable of providing a report of the history of tests and failures by display on a built-in screen on the central battery enclosure.
5. A Monitoring and Reporting System (MARS) shall be capable of automatically creating and sending emails via internet to any designated address, containing fault reports and test result history as required.
6. The battery and charger system enclosure shall be a NEMA Type 1, UL 50 steel cabinet, for surface or optional recessed mount.
7. Maintenance on the batteries or other electronics for all emergency lighting equipment on one building floor can be performed without requiring access to the lighting fixtures, except for lamp failures.
8. The DC wiring output terminals in each CBS system shall have up to 8 circuits available for lighting devices.

D. In exposed or non-accessible ceilings, emergency power cabling shall be installed in conduit.

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. Install light fixtures in accordance with the manufacturer’s written instructions, the applicable requirements of NEC and the National Electrical Contractors Association’s “Standard of Installation”.
C. If a fixture type designation is omitted, furnish fixture of the same type as shown for rooms of similar usage. Verify with Owner’s Project Manager before purchase and installation.
D. Check the building electrical system requirements and architectural finishes. Regardless of the catalog number prefixes and suffixes shown, furnish fixtures with the proper trim, frames, supports, hangers, ballasts, voltage rating, and other miscellaneous appurtenances to properly coordinate with Project conditions. Verify with Owner’s Project Manager prior to ordering.
E. Check the type of ceilings to be installed in each room and verify that the recessed light fixtures are proper for the type of ceiling to be installed before ordering fixtures. Provide a frame compatible with the type of ceiling in which the recessed lighting fixture is installed. Refer to the Architectural Room Finish Schedule for the specified ceiling type.
F. Fixtures shall be securely attached to the ceiling-framing members by mechanical means. Clips identified for use with the type of ceiling framing member(s) and fixture(s) shall also be permitted. Fasten lighting fixtures in areas where there is no ceiling securely to the structure.

G. Immediately before final observation, clean all fixtures, inside and out, including plastics and glassware, and adjust all trim to properly fit adjacent surface, replace broken or damaged parts, and lamp and test all fixtures for electrical as well as mechanical operation.

H. Protect installed fixtures from damage during the remainder of the construction period.

I. Wiring methods:
   1. Lighting fixtures shall be connected to a typical metal conduit, junction box, and wire lighting grid system.
   2. Modular cabling, flexible whip assemblies, feed through wiring, ‘daisy-chain’ feeds, tandem wiring and other similar wiring methods are not acceptable for the lighting circuit distribution and wiring system.

3.2 TESTING

A. Upon completion of installation of interior lighting fixtures, and after circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at the Project Site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

B. All existing fixtures in work area that are re-used or relocated shall be cleaned inside and out, broken or damaged parts replaced and new lamps installed.

3.3 LIGHTING FIXTURE SCHEDULE

A. Refer to Lighting Fixture Schedule on Drawings for list of specified manufacturers for each fixture proposed.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Microprocessor based 24 volt DC, closed circuit, electrically supervised, non-coded, intelligent fire alarm system, including:
   1. Control equipment.
   2. Power supplies.
   4. Signaling devices.

B. Initiating Device Circuit (IDC) shall be wired as Style B. Initiating Appliance Circuit (IAC) shall be wired as Style Y. Signaling Line Circuit (SLC) shall be wired as Style 4.

1.2 RELATED SECTIONS

A. Section 26 09 19 – Cable, Wire And Connectors

B. Section 26 05 33 - Raceway, Conduits and Boxes

1.3 REFERENCES

A. NFPA 70 - National Electrical Code.


1.4 SYSTEM OPERATION

A. Verification Sequence:
   1. If an intelligent smoke detector senses a trouble level of smoke, provide for the interface module to automatically initiate a "check" mode. Provide a minimum of four consecutive samples of the prospective detector. Upon completion of the consecutive smoke trouble conditions, the detector is considered "checked" and the system goes directly into an alarm mode.
   2. Provide alarm verification, as field programmed, to initiate the verification sequence after the above "check" procedure. Provide a field programmable delay period (0 to 50 seconds) before proceeding to resample the detector. Initiate all alarm sequences specified if three or more samples verify an alarm condition still exists. Log in memory the number of verification events that have occurred for each selected device.

B. Alarm Detection Sequence:
   1. Upon detection by any initiating device, flash the system common alarm LED on the CPU module and sound the internal audible trouble device. Acknowledging the alarm condition silences the audible trouble device and causes the flashing common alarm LED to illuminate steady.
   2. Indicate all applicable information on an 80 character display associated with the alarm condition including: zone, device type, device location, and time of alarm.
   3. Transmit appropriate status change messages to CRT’s and printers.
4. Any remote annunciator LED’s associated with the alarm point illuminate as herein specified.
5. Relay the alarm signal to the remote signaling or municipal tie connection.
6. Execute all automatic events programmed to the alarm point and activate the associated indicating devices and/or outputs.
7. Sound alarm tones on the floor of incidence, floor above and floor below. Upon expiration of the alert tone, automatically transmit a digitized predetermined voice evacuation message to the affected floors. Generate multiple distinct digital messages as determined by event initiated programs.
8. Activate all audible/visual alarm devices on the floor of incidence, floor above, and floor below.
9. Deactivate HVAC systems on the floor of incidence(s).
10. Activate stair pressurization fans.
11. Recall elevators to the ground floor or to the alternate terminus floor.
12. Unlock stairwell doors.

C. Trouble Detection Sequence:
1. Upon trouble detection, flash the system trouble LED on the CPU module and sound the internal audible trouble device. Acknowledging the trouble condition silences the audible trouble device and causes all trouble LED’s to illuminate steady.
2. Indicate all applicable information on an 80 character display associated with the trouble condition and its location.
3. Provide priority for unacknowledged alarms/messages over any trouble displays and priority precedence on the annunciator.
4. Transmit appropriate status change/messages to CRT’s and printers.
5. Illuminate any remote trouble annunciator LED’s as herein specified.

D. Elevators:
1. Upon activation of detectors associated with an elevator lobby, recall all elevators to the ground floor. In the event of a fire on the ground floor, automatically recall all elevators to the first terminus floor above the ground floor served by the respective elevator bank.
2. Maintain in operation banks of elevators not recalled by activation of the lobby detectors until such time as specified herein.

E. Auxiliary and Remote:
1. Maintain in operation all designated "non-silenceable" auxiliary control functions, even upon silencing of audible alarms, until such time as the control panel is cleared and reset manually (i.e. fan control outputs, central station interface, elevator recall interface, etc.).
2. Provide annunciator(s) that duplicate the control panel alarm status indicators for selected system zones/points and annunciate any system trouble conditions as herein specified.

1.5 SUBMITTALS

A. Shop Drawings: Indicate conduit and cable sizes and routing. Include riser diagram of zoning.

B. Product Data: Include sequence of operation interfacing alarm zones and signal zones.

C. Provide operation and maintenance manual. Furnish written operating instructions and system schematic diagram to Owner’s representative.
1.6 QUALITY ASSURANCE

A. Equipment Supplier Qualifications:
   1. Authorized and designated representative of fire alarm manufacturer to sell, install, and service proposed manufacturer's equipment. Verify equipment supplier has technical factory training specifically for the system proposed.
   2. Licensed by State Fire Marshall to sell, install, and service fire alarm systems.
   3. Actively engaged in business of selling, installing, and servicing fire alarm systems for at least seven years with minimum of ten installations in operation.
   4. Provide 24 hour, 365 days per year emergency service with qualified and state licensed service technicians.

B. Installer Qualifications: Licensed by State Fire Marshall to sell, install, and service fire alarm systems.

C. Provide staff installation superintendents who are licensed by the State Fire Marshall's office for such purpose and under whose supervision installation, final connections, and testing will be performed.

1.7 MAINTENANCE SERVICE

A. Provide continued program of system maintenance in compliance with NFPA 72.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. EST.

B. Notifier.

C. Simplex.

2.2 FIRE ALARM CONTROL PANEL

A. Provide a control panel modular in design utilizing distributed solid state, field programmable microprocessors. Provide capacity for the required active detection and output points with space for future use and expansion. Provide hinged door with key lock and a transparent window for viewing all alarm/trouble indicators and LCD annunciator.

B. Provide programmable non-volatile RAM memory. Provide capability to communicate with monitor and control all other modules in the panel via internal serial communications techniques. Provide detection upon removal, disconnection or failure of any control panel module.

C. Maintain all custom time or control-by-event programs for specified events in non-volatile memory. Provide for no program loss, if system primary and secondary power failure occurs.

D. Provide a real-time clock circuit to execute custom time control programs and time/date stamp system events.

E. Provide touchpad controls and indicators for use by the system operator to program all control panel and system parameters. Provide custom display of alpha-numeric labels.
for all intelligent detectors, zones, and addressable modules. Store label information in
non-volatile memory.

F. Provide an 80-character alpha-numeric liquid crystal display (LCD). Provide light-emitting
diodes (LED's) for AC power, system alarm, system trouble, display trouble and disable.

G. Provide a keypad with capability to control all system functions, status readouts, manual
control action, and entry of any alphabetic or numeric information. Include means to
enter multiple five-digit passwords to prevent unauthorized manual control or
programming from the keypad. Provide multiple levels of password protection.

H. Provide interface for remote CRT’s.

I. Provide interface for remote printers.

J. Provide interface for supervised remote LED annunciators.

K. Provide for monitoring and controlling of each loop of intelligent detectors and
addressable modules. Include an independent microprocessor control capable of alarm
detection with automatic default mode if a failure occurs in the system central processor
unit, internal connections, or other modules.

L. Provide for receiving digital/analog information from all intelligent detectors and process
this information to determine normal, alarm, trouble, and sensitivity conditions. Use
analog information for automatic test and determination of maintenance requirements.
Individually monitor all intelligent detectors for sensitivity variation and initiate a trouble
condition should detector sensitivity "drift" toward either threshold or false alarming or
non-alarming conditions. Monitor each detector's sensitivity, and if need be, electronically adjust the detector sensitivity as required for existing conditions within UL
recommended limits.

M. Communicate continuously with each intelligent detector and addressable module on its
loop and verify its proper function and individual status. Perform communication with up
to 198 such devices per loop an average of every three seconds or less.

N. Control Switches:
   1. Acknowledge/step switch.
   2. Signal silence switch.
   4. System test switch.
   5. Lamp test.

O. Non-Lock Walk Test: Provide a special non-lock "walk test" mode where each initiating
device is manually placed in alarm. Pulse the system audible devices from the control
panel on detection of each such alarm and automatically reset the panel, permitting a
single serviceman to functionally test the entire system.

P. Automatic Detector Test:
   1. Provide a special automatic detector test feature which permits reading and
      adjusting the sensitivity of all intelligent detectors from the main control panel. In
      addition, permit the functional testing of any intelligent detector or addressable
      interface device individually or by zone from the main control panel. Indicate the
      results of the test on the LCD display.
   2. Provide printout of all test data via the system printer/recorder.
Q. Special System Reports:
1. Generate and print system and point status reports upon command.
2. Selection of "system" read status provides the operator with global system programming information including: alarm verification, SLC loop styles, number of SLC loops, number of software zones, number of auxiliary power supplies, signal silence inhibit.
3. Selection of "point" read status provides the operator with selected individual point programming data including: point status (normal, alarm, trouble, disabled, etc.), address, type I.D., control by event, custom alphanumeric label, verification status, alarm threshold level, sensitivity, silenceable/non-silenceable, SLC loop number, and device number.

R. System Diagnostics:
1. Provide special software to detect, diagnose and report failures and isolate such failures to a printed circuit board level. Periodically perform independent self test routines as a self operational/performance test for each module via its resident, independent processor. Report any irregularities via the LCD display and trouble indicators.
2. Provide a lamp test function to test all system indicators including the LCD display and test the panel trouble device for proper operation.
3. Provide a keypad test function allowing the user to interactively confirm that all keys are functional and operating correctly.
4. Provide independent timer software to detect and report failure of any microprocessor circuit, memory, or software. The function of this safe-guard software/circuitry is to restart the respective processor and maintain proper operation of the system. In addition, the master CPU has control over a hardware reset terminal which can perform a system-wide restart. Systems employing tape or disk drive rebooting will not be acceptable.

S. Field Programming:
1. Provide a 100 percent field programmable system without the need for external computers, PROM programmers, or replacement of memory IC's. Systems requiring factory programming/ reprogramming or field replacement of IC memory chips will not be acceptable. All programming may be accomplished through the front control panel indicators and switches or via CRT/keyboard unit. Store all programs in non-volatile RAM memory.
2. Secure programming with an appropriate, pre-selected, five-digit password security code of the highest security level. Do not require the system to be taken off-line or prohibit the system from performing its normal operations and routines while in the system programming mode.
3. Initiate all programming functions via special system "prompting" menus via the system main CPU. Provide a means to "review" all programmed functions at any time subsequent to initialization.
4. Provide the capability to revise/change programmed functions or system expansion at anytime subsequent to initialization as described herein without factory modifications or factory reprogramming. Field programming via the use of external computers may be considered provided programming can be accomplished on-site and the owner permanently furnished with required programming apparatus as part of this contract.

T. Event History:
1. Store a minimum of 1000 system events in chronological order of occurrence. Include event history for all system alarms, troubles, operator actions (i.e. acknowledge, silence, reset, program entry, etc.), unverified alarms, circuit/point alterations, component failures. Time and date stamp events and record and/or
review without purging the history file. Store events in non-volatile buffer memory.
2. Automatically overwrite the oldest event(s) in memory beyond the initial 1000 events.
3. Provide a system with event history memory storage.
4. Provide electronic download of all event history data to portable laptop, thumb drive, or other similar storage device.
5. Provide printer/recorder for recording system events.

U. Power Supply:
1. Provide an integral power supply for the panel and all fire alarm peripherals. Provide all control panel and peripheral power needs with filtered power.
2. Design all power supplies to meet UL and NFPA requirements for power-limited operation on all external signaling lines, including initiating circuits and indicating circuits. Provide UL listing for all power-limited circuit applications and use positive temperature coefficient devices for current limiting.
3. Provide input power rated at 120 volts, 60 hertz. Provide internal supervised batteries and automatic charger. Provide both positive and negative ground fault supervision, battery/charger fail condition, AC power fail indicators. Provide supervision of modular expansion power supplies as may be required.

2.3 VOICE COMMUNICATIONS

A. Modular in design utilizing solid state microprocessor circuitry with future expansion. Dead front construction with space for future use and expansion of communications circuits.

B. Communications Controls and Indicators:
1. ALL CALL selector switch with LED indicator.
2. GENERAL ALARM selector switch with LED indicator.
3. AUDIO TROUBLE LED indicator.
4. AUDIO LEVEL LED indicator.
5. MANUAL TONE/MESSAGE selector switches with LED indicators.
6. COMMUNICATIONS PILOT/STATUS LED indicator.
7. TELEPHONE REMOTE PAGE selector.
8. COMMUNICATION ZONE selector switches with LED select indicators.
9. Communications monitor speaker with volume control.
10. Dynamic paging microphone.
11. Master firefighter's telephone handset.
12. TELEPHONE TROUBLE LED indicator.
13. TELEPHONE LINE TROUBLE indicator.

C. Paging:
1. Provide a one way paging system with a means to selectively and simultaneously activate voice, tones or digitized messages to any or all zones in the system via electronic membrane touchpad controls. Provide visual indication by zone, for zones selected.
2. Totally supervise each audio/speaker circuit for opens, shorts or grounds with direct shorts prohibiting selection of the respective zone. Provide power-limited audio circuits per the latest UL and NEC Standards. Provide each speaker zone with an amber trouble LED for circuit trouble conditions and an active/on LED indicator.
3. Alarm/Paging Zones:
   a. One zone each level/floor.
   b. One zone each stairwell.
c. One zone each elevator bank (to include all elevator cabs in respective bank).

D. Alarm Electronics and Sequence:
1. Provide a microprocessor based, supervised, multi-function, audio generator for the voice communications center including:
   a. Voice communications CPU.
   b. Non-volatile RAM memory.
   c. Communications configuration dip switches.
   d. Three standard digitized voice message circuits.
   e. Up to four selectable tone generator/oscillators.
2. Provide each sub-circuit of the communications center fully supervised. Revert the system to the default standby generator upon failure of any tone oscillator or digital message generator. Indicate audibly and visually any system/sub-system failure by a system trouble condition.
3. Provide any combination of standard digitized factory programmed messages, custom field programmable digitized messages, and/or control-by-event program. Provide custom message programming at the main fire alarm communications panel without the need of special programming/recording apparatus or off-site programming. Mechanical tape decks/drive will not be acceptable.
4. Provide amplifier expansion capacity as required for tenant area development. Continuously monitor each amplifier electronically for proper output level. Equip each unit with its own trouble LED, battery input trouble LED, and amplifier trouble/fail LED. Annunciate audibly and visually any fault or trouble condition via the system trouble sequence.

E. Firefighter's Telephone System:
1. Provide two-way, voice telephone communications via a firefighter's master telephone handset capable of simultaneous communication to multiple zones. Provide a microprocessor based system with controls and signal generator.
2. Telephone Zones:
   a. Each floor/level shall be a zone.
   b. Each stairwell shall be a zone.
   c. Each bank of elevator cabs shall be a zone.
3. Provide separate supervised circuits for each stairwell's building emergency telephones.

F. Remote Transponder Panels:
1. Provide transponders as required by manufacturer. Provide all functions field programmable via the main system CPU and store in non-volatile RAM memory. Should communication with the main CPU be disrupted, provide each unit capable of operating independently in the default mode.
2. Provide an integral power supply for the transponder and all peripherals served by the transponder. Design all power supplies to meet UL and NFPA requirements of power-limited operation on all external signaling lines, including initiating circuits and indicating circuits. Provide UL listing for power-limited circuit applications.
3. Provide input power rated at 120 volts, 60 hertz. Provide internal supervised batteries and automatic charger. Provide both positive and negative ground fault supervision, battery/charger fail condition, AC power fail indicators.
4. House transponder in key-locked steel cabinet painted in baked enamel finish. Provide cabinets with conduit knockouts on sides and top for versatility in installation. Provide the cabinet(s) with the capability of accommodating multiple
transponder units in a single enclosure if desired.

2.4 FIELD DEVICES

A. Monitor Modules:
   1. Provide addressable monitor modules where required to interface to contact alarm devices. Provide monitor modules to connect a supervised zone of conventional initiating devices (an N.O. dry contact device, including 4-wire smoke detectors) to an intelligent SLC loop. Mount in a 4-inch square electrical box. Wire each zone for Class B, field selectable.
   2. Provide address-setting means and store an internal identification code which the control panel shall use to identify the type of device. No binary coding shall be required. Flash status/power LED under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel. The LED may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected.
   3. Provide a magnetic test feature to field test the unit for functional operation. Provide an automatic test feature to permit functional testing of the device from the main control panel. Indicate results of the test on the LCD display.

B. Control Modules:
   1. Provide control/relay modules where required to provide audible alarm interface and/or relay control interface. Provide control modules to connect a supervised zone of conventional indicating devices (any 24 volt polarized audio/visual indicating appliance) to an intelligent loop. Mount in a standard 4-inch electrical box. Wire each zone Class B, field selectable. The control module may be optionally wired as dry contact (Form C) relay. Provide power for the relay actuation from the intelligent detector loop to reduce wiring connection requirements. Provide audio/visual power from a separate loop from the main control panel or from supervised remote power supplies.
   2. Provide address-setting means and store an internal identification code which the control panel shall use to identify the type of device. No binary coding shall be required. Flash status LED under normal conditions, indicating that the control module is operational and in regular communication with the control panel. The LED may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected.

C. Remote Annunciators:
   1. Provide supervised remote LED annunciators. Provide field programmable annunciators to annunciate selected given points and/or zones. Configure each annunciator as remote system control and annunciator unit. Provide alarm and trouble LED's per annunciated function.
   2. Provide a local alarm/trouble Piezo sounder and acknowledge/lamp test switch. Provide a common trouble LED and on line/pilot LED indicators. Zone LED indicators to flash upon receipt of alarm (or trouble) conditions and revert to steady state upon system or annunciator acknowledgement. Silence local sounder upon acknowledging.
   3. Duplicate system control capability as follows: System acknowledge/trouble silence, signal silence, lamp test, system reset, signal silence LED, and system alarm and trouble LED's.

D. Intelligent Photoelectric Smoke Detectors:
   1. Provide analog photoelectric smoke detectors. Provide detectors utilizing the photoelectric principal to measure smoke density and on command from the control panel, send data to the panel representing the ANALOG level of smoke
density. Provide automatic sensitivity “drift” compensation to provide longer term stability and reliability. Provide a “maintenance alert” feature whereby the detector initiates a trouble condition should the units sensitivity approach the outside limits of the normal sensitivity window. Provide the detector with extensive RF and EMF noise reduction circuitry. Provide self compensating solid state LED light source and photosensitive circuitry.

2. Provide a calibrated test method whereby the detectors will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself by activating the detector magnetic test switch, or may be activated remotely on command from the control panel.

3. Provide address-setting means and store an internal identification code for each detector which the control panel can use to identify the type of detector.

4. Provide dual alarm and power/status LED’s. Flash status LED’s under normal conditions, indicating that the detector is operational and in regular communication with the control panel. Both LED’s may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected and verified. Provide an output connection in the base to connect an external remote alarm LED.

5. Provide semi-flush ceiling mounted, modular detector head with twist-lock base. Provide in smooth attractive white finish, and back-sealed against dirt, vermin, and back pressure. Provide with fine mesh insect/contaminate screen. Provide UL listing with respective control panel.

E. Intelligent Thermal Detectors:

1. Provide analog thermal detectors. Provide detectors utilizing dual electronic thermostats to measure temperature levels in its chamber and on command from the control panel, send data to the panel representing the analog temperature level.

2. Provide a calibrated test method whereby detectors will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself, by activating a magnetic switch, or may be activated remotely on command from the control panel.

3. Provide address-setting means and store an internal identification code for each detector that control panel can use to identify the type of detector.

4. Provide dual alarm and power/status LED’s. Flash status LED’s under normal conditions, indicating that the detector is operational and in regular communication with the control panel. Both LED’s may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. Provide an output connection in the base to connect an external remote alarm LED.

5. Provide semi-flush, ceiling mounted, modular detector head with twist-lock base.

F. Intelligent Duct Detectors:

1. Provide duct mounted intelligent photoelectric smoke detectors. Provide detectors operating on the same principles and exhibiting the same basic characteristics as area type intelligent smoke detectors. Provide units capable of interchanging/accepting either photoelectric or ionization type sensors. Provide detectors operating in air velocities of 300 feet per minute to 4,000 feet per minute without adverse effects on detector sensitivity. Provide detectors which interface directly to the system without interface zone modules.

2. Provide a noryl molded plastic enclosure with integral conduit knockouts. Provide housing with gasket seals to insure proper seating of the housing to the associated ductwork. Provide sampling tubes that extend a minimum of 75 percent across the width of the duct. Provide porosity filters to reduce
sensor/chamber contamination. Provide with integral single pole double throw auxiliary control contacts.

G. Addressable Manual Pull Stations:
1. Provide dual action type manual pull stations. On command from the control panel, send data to the panel representing the state of the manual station.
2. Provide address-setting means and store an internal identification code which the control panel can use to identify the type of device. Flash status LED's under normal conditions, indicating that the manual station is operational and in regular communication with the control panel. The LED may be placed into steady illumination by the control panel, indicating that an alarm condition has been initiated via the station.
3. Provide semi-flush mounted stations on standard electrical box. Construct of hi-impact red molded Lexan with instructions for station operation in raised white letters.

H. Speaker/Strobes:
1. Provide audible alarm devices capable of producing both tone alerts and voice communication instructions.
2. Provide built-in matching transformer, field selectable multiple power taps, circuitry for speaker/line supervision, and screw terminal connection points.
3. Provide 4-inch round or square speaker assembly with white decorative metal grille. Provide for flush wall or ceiling mounting.
4. Provide visual alarm devices integral with audible alarm devices, operable on 24 volts DC, utilizing a high intensity solid state xenon strobe tube producing 8,000 candle power. Connect strobe lights to supervised circuits.

I. Speakers:
1. Provide audible alarm devices capable of producing both tone alerts and voice communication instructions.
2. Provide built-in matching transformer, field selectable multiple power taps, circuitry for speaker/line supervision, and screw terminal connection points.
3. Provide 4-inch round or square speaker assembly with white decorative metal grille. Provide for flush wall or ceiling mounting.

J. Water Flow Detectors: Provide interface to monitor water flow detectors. Coordinate quantity and location with the fire sprinkler contractor.

K. Supervisory Valves: Provide interface to monitor supervisory valves on each fire protection piping valve. Coordinate quantity and location with the fire sprinkler contractor.

L. Auxiliary Relays: Provide relays for ventilating and air handling control and interface. Provide heavy duty type rated up to 10 amps at 24 volts DC. Provide with NEMA I dust cover assembly and single pole double throw contacts.

M. Telephone Jacks: Provide remote handset jacks flush mounted on brushed aluminum plates.

N. Portable Telephone Handsets: Provide total of five portable handsets of molded ABS plastic with retractable cords. Provide dynamic transducer with solid state amplifier. Store portable handsets at firefighter's command center.

PART 3 - EXECUTION
3.1 PREPARATION

A. Only basic equipment devices have been shown on the contract drawings. Specific wiring between equipment/devices has not been shown. It is the contractor responsibility to submit for approval the complete engineered system configuration and layout showing all devices, wiring, conduit, and locations along with other required information as specified herein.

B. Field program all devices into software zones for the purpose of general area identification (i.e., floor, wing, etc.) and annunciation. Provide for each device to also be separately annunciated including exact location and device type.

C. Verify interface requirements for other systems and devices.

D. Obtain authorization from building officials having jurisdiction.

3.2 CABLE INSTALLATION

A. Provide cable in accordance with NFPA 72, NFPA 70, and local codes. Provide cable sizes conforming to manufacturer's recommendations.

B. Provide twisted/shielded type cable to guard against outside RF and EMF interference and induced noise.

C. Where required by local code, provide cable in minimum size 1/2-inch conduit. Do not install AC wiring or any other wiring in the same conduit as fire alarm wiring. Otherwise, provide limited energy FPLP cable (plenum rated) run open in return air ceiling plenums provided cable is UL listed to UL Test 910 for such applications, is of the low smoke producing fluorocarbon type, and complies with NFPA 70, Article 760-4(d) if so approved by the local authority having jurisdiction.

D. Install all vertical cable, all main trunk/riser cable and all cable in conduit and within a fire rated chase. Adequately size all riser boxes for the number of cables transversing the respective box as well as the number of terminations required.

E. Connect all cable in a supervised fashion per NFPA requirements such that any wiring disarrangement will initiate the appropriate trouble signals via the main control panel per NFPA and UL requirements. Intelligent loops may be T-trapped/branch wired due to inherent dynamic supervision.

F. Minimize wiring splices. Where required, make in designated terminal boxes or at field device junction boxes. Do not transpose color coded wiring.

G. Label cable at terminations and pull boxes, junction boxes, and outlet boxes.

3.3 INSTALLATION

A. Provide system grounding.

B. Provide dedicated 20 amp, 120 volt circuits from the emergency distribution system panelboards to all fire alarm equipment (control panels, auxiliary power panels, transponders, etc.).

C. Provide interfaces to other systems and devices furnished under other divisions and sections.
3.4 INTERFACE WITH OTHER WORK

A. Coordinate requirements surrounding installation of the fire alarm system with all trades including, but not exclusive of the elevator system, electrical system, sprinkler system, and HVAC/controls system. Provide adequate coordination to insure proper installation and interface to all peripheral items required to interact with the fire alarm and communication system to provide a complete and functional life safety system.

B. Central station connection and service provided by the Owner.

3.5 FIELD QUALITY CONTROL

A. Provide services of manufacturer's representative to instruct Owner's personnel in system operation and maintenance.

B. Perform the final control panel connections and supervise testing of the system by a state licensed factory trained technical representative of the manufacturer. It shall be subject to the approval of the responsible engineer and owner. Upon completion of the acceptance tests, the owner and/or his representatives shall be instructed in the proper operation of the system.

C. Functionally test each and every device in entire system for proper operation and response. Test each circuit in system for wiring supervision to insure proper wiring installation. Any items found not properly installed or non-functioning shall be replaced or repaired and retested. All testing shall be supervised by a licensed fire alarm superintendent.

D. Provide complete written report on functional test of entire system. Test and report shall verify function of each device in system, operation of all auxiliary control functions, and proper operation of main fire alarm control panel. Provide copy of test report with maintenance manuals. Test report shall be signed and dated by licensed fire alarm superintendent responsible for supervising final system test and checkout.

E. Test entire system in presence of local authorities having jurisdiction.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.

1.02 SUMMARY

A. Provide ALTERNATE BID for Design and provide a complete lightning protection system consisting of air terminals, conductors, connectors, attachments, ground ring electrode, grounding, bonding and necessary appurtenances to comply with minimum requirements listed in the referenced standards.

B. This Section specifies the system design, materials, installation, grounding, bonding, appurtenances, inspections and certification required for a comprehensive lightning protection system.

C. This Section also includes all necessary Work to connect all newly installed fan stacks and other appurtenances to the existing UL master labeled system.

D. This Section shall be used in conjunction with the following other specifications and related Contract Documents to establish the total requirements for lightning protection systems.

   1. Section 26 01 00 - Basic Electrical Requirements
   2. Section 26 05 26 - Grounding
   3. Section 26 05 33 - Raceways, Conduits, and Boxes

1.03 REFERENCE STANDARDS

A. The materials and installation shall conform to the minimum requirements and latest revisions of the following codes, standards and regulations wherein they apply:

   1. NFPA 70 - National Electrical Code
   2. UL 96 - Lightning Protection Components
   3. UL 96A – Installation Requirements for Lightning Protection Systems
   4. NFPA 780 – Standards for the Installation of Lightning Protection Systems
   5. LPI 175 - Standard of Practice for the Design - Installation - Inspection of Lightning Protection Systems

1.04 QUALITY ASSURANCE

A. Manufacturer: Company specializing in lightning protection equipment with minimum three years documented experience and material compliance with UL requirement.

B. Contractor Qualifications:
1. The Contractor for the Work covered by this Specification shall be one that is recognized as being regularly engaged in the design and installation of lightning protection systems.

2. The Contractor must be listed by Underwriters Laboratories, Inc., and must employ competent personnel fully qualified in the field of lightning protection. The Contractor must have minimum ten years documented experience.

C. Master Label:

1. The system design and installation shall meet or exceed the requirements of UL 96A for a Master “C” Label. UL master label shall be obtained.

2. Upon completion, the lightning protection system shall be inspected by a representative of Underwriters Laboratories, Inc.

3. The lightning protection system must pass the UL inspection. If the system does not pass inspection, the Contractor must make corrections to the system to pass inspection.

1.05 SYSTEM DESIGN

A. The lightning protection system components on building roof shall be taken into consideration during the building’s design phase. System components can be built in so as to be protected from mechanical displacement, and environmental effects. In addition, aesthetic advantages can be gained by such concealment especially for low-rise buildings where exposed lightning protection system components on building roof can be highly visible. Alternate installation detail for rooftop lightning terminals shall be developed if the attachment to parapet wall is prohibited due to the concern of roof warranty.

B. Main conductors shall interconnect all strike termination devices and shall form two or more paths from each strike termination device downward, or horizontally. Main conductors shall be installed on building roof. Roof penetration can be minimized for the entry of down conductors and interconnecting conductors.

C. When a lightning conductor system is placed on a building, within or about which there are metal objects of considerable size within a few feet of a conductor, there will be a tendency for sparks or side flashes to jump between the metal object and the conductor. To prevent damage, interconnecting conductors should be provided at all places where side flashes are likely to occur.

D. A ground ring electrode (counterpoise conductor loop) encircling a structure shall be designed to connect down conductors and grounding electrodes.

E. Provide intermediate-level potential equalization for reinforced concrete structure buildings, interconnecting the lightning protection system down conductors and other grounded media with a loop conductor at intermediate levels not exceeding 200 ft per NFPA 780.

1.06 SUBMITTALS

A. Product Data:

1. Product Data: Submit complete descriptive information on all materials and installation methods. Product data showing dimensions and materials of each component, and include indication of listing in accordance with UL 96.

B. Record Documents:

1. Shop Drawings:

   a. Detailed plan drawings shall be prepared to 1/8" = 1'-0" scale which indicates all Work to be performed.
b. Shop drawings showing layout of air terminals, grounding electrodes, and bonding connections to structure and other metal objects. Include air terminal, grounding electrode, conductor sizes, connections, and termination details.

c. Shop drawings shall include locations of conductors, roof penetrations, floor penetrations, etc., and their compatibility with provisions made during the construction. Once the contract has been established the Contractor shall make a review of provisions being made for the system installation and comment, in writing, with changes or compliance within two weeks of finalizing the contract. Contractor shall coordinate locations of conductors in walls and all penetrations with the appropriate trades: Failure to coordinate these requirements shall not relieve lightning protection Contractor from properly completing its work. This Contractor shall employ the proper trades to provide the chases in walls and roof and floor penetrations required to install the conductors if not coordinated before the floors, walls and roof are installed.

d. Manufacturer's catalog numbers and generic identification shall be indicated for all components shown on the Drawings.

e. As Built Record Drawings: The Contractor shall maintain a master set of As Built Record Drawings that shows changes and any other deviations from the Base Drawings.

2. Approvals: Secure formal approval of Shop Drawings and product data prior to ordering material or installation.

PART 2 - PRODUCTS

2.01 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

B. The system provided under this specification shall be the standard product of a manufacturer regularly engaged in the production of lightning protection systems and shall be the manufacturer's latest approved design.

C. Listing of the manufacturer in the lightning protection section of the current edition of Underwriters' Laboratories, Inc., Electrical Construction Materials List will be accepted as compliance with this requirement.

D. Materials used in connection with the installation of the lightning protection system shall be approved for lightning protection systems by the Underwriters' Laboratories, Inc.

E. No combination of materials shall be used that forms an electrolytic couple of such nature that corrosion is accelerated in the presence of moisture.

F. Where unusual conditions exist which would cause deterioration on corrosion of conductors, conductors with suitable protective coatings or oversize conductors shall be used.

G. If a mechanical hazard is involved, the conductor size shall be increased to compensate therefore, or suitable protection shall be provided.

H. The conductors may be protected by covering them with molding or tubing made of nonmagnetic material.

I. Aluminum materials may not be used except on roofs that utilize aluminum roofing components. When aluminum materials are used, provide all materials of aluminum composition to ensure compatibility, except down conductors and grounding. Provide copper down conductors with bimetal transition at the roof assembly rated for the application.
2.02 CONDUCTORS
   A. All conductors shall be stranded or braided copper and of the grade ordinarily required for commercial electrical work generally designated as being 98 percent conductive when annealed.
   B. Conductor minimum sizes are per NFPA 780.

2.03 AIR TERMINALS
   A. Air terminals shall be nickel-plated solid copper with tapered bullet point tips (in lieu of sharp point tips).
   B. Minimum air terminal size shall be 5/8 inch diameter by 24 inches long. Where air terminals longer than 24 inches are required, solid copper rods of the appropriate length with threaded ends may be securely attached to the air terminals for extensions.
   C. Provide a three-leg tripod brace for each air terminal over 24 inches long. Secure the triangular brace to the roof in a manner approved by the roof vendor. Conductor connections to air terminals shall be bolted.

2.04 GROUND RODS
   A. Ground rods shall be copper-clad steel, ¾-inch diameter by 10 feet in length.

2.05 CONNECTIONS
   A. All below ground and concealed connections shall be made with exothermic welded connections.
   B. Visible connections shall be made with cast bronze bolted pressure connectors that utilize stainless steel or silicon bronze bolts.
   C. Connectors shall be:
       1. Thompson No. 424B (4 inch parallel clamp) for conductors,
       2. Thompson No. 702 bonding plate,
       3. Thompson No. 637 cross-run clamp or accepted substitution.

2.06 ROOF PENETRATIONS
   A. Roof penetrations shall be accomplished with through-roof fittings specially designed for this purpose. Fittings shall incorporate a positive means for sealing around the penetration.

PART 3 - EXECUTION

3.01 PREPARATION:
   A. Design and provide a complete lightning protection system consisting of air terminals, conductors, connectors, attachments, ground ring electrode, grounding, bonding and necessary appurtenances to comply with minimum requirements listed in the referenced standards.
   B. The system shall be installed in a neat workmanlike manner and without interfering with other building systems.
   C. Verify that surfaces are ready to receive work, and field measurements are as shown on the shop drawings. Beginning of installation means installer accepts existing conditions.
   D. Protect elements surrounding work of this Section from damage or disfiguration.
3.02 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 manufacturer’s published recommendations.

C. Conductors:
   1. Down conductors are required. Concealed down conductors shall be installed in continuous insulating PVC raceways. Metallic raceways shall not be used.
      a. Building steel cannot be substituted for down conductors.
      b. All down conductors must be concealed.
   2. Secure conductors to the roof or other structure at a maximum interval of 3 feet.

D. Air Terminals:
   1. Air terminal installations shall be designed and braced for 100-mph winds with 125-mph gusts.

E. Connections:
   1. At the completion of the Project, all bolted connectors shall be checked for proper bolt torque.

F. Roof Attachments and Penetrations:
   1. Air terminals, conductors and appurtenances for the lightning protection system require attachment to building roofs.
   2. Down conductors require penetration of roof surfaces. All attachments to or penetrations through roofs must be in strict accordance with the roof manufacturer’s recommendations.
   3. Coordinate roof penetrations with Architectural Drawings.
   4. The Contractor shall submit details of all roof attachments and penetrations to the appropriate roof manufacturer for approval prior to installation.
   5. Once the lightning protection system installation is complete, the Contractor shall engage the appropriate roof manufacturer to inspect all roof attachments and penetrations on that manufacturer’s roof.
      a. Subsequent to the inspection, the roof manufacturer shall furnish the Owner with a letter indicating that all lightning protection system component roof attachments and penetrations are satisfactory and that such attachments and penetrations will not in any way reduce the manufacturer’s warranty on the roof.
      b. Any fees for services or inspections provided by the roof manufacturer to accomplish the above related requirements shall be at the expense of the Contractor.

G. Cover-Up Inspection:
   1. Prior to cover-up of concealed components and connections, notify the Owner so that a cover-up inspection can be performed. Correct any deficiencies and request a final inspection by the Owner prior to concealment of components and connections.

H. Conflicts:
1. In the event a conflict exists between this Specification and any of the referenced standards, the requirements of referenced standards govern. Necessary variances or corrections shall be made at the expense of the lightning protection contractor in order to obtain UL Master Label.

END OF SECTION
PART 1 GENERAL

1.1. SUMMARY

A. Section Includes: Access Control software for server and clients, server and client computer hardware, server and client operating systems, credential database, controllers and sub-controllers, access control hardware for doors.

B. The Contractor shall provide all materials, equipment, labor and all other incidental materials and appliances necessary, as described herein and in the drawings, to provide a complete turnkey and functional system, regardless of any materials and/or equipment not listed or described in this specification and/or supplementary drawings.

C. The installing contractor shall provide all necessary devices on the access control system, according to the installation instructions furnished with each product and as outlined in this section.

D. Coordinate with Owner to confirm if keypad or card readers are preferred prior to ordering equipment.

E. Related Requirements

1.2. REFERENCES

A. Abbreviations And Acronyms

B. Definitions

1. Controller: Electronic device capable of making the decision to allow access based on time, door, and credential presented.

2. Sub-Controller: Electronic device used to send information to the controller to initiate a request for access. Sub-controllers collect analog information from door hardware such as door contacts along with digital information from credential readers. This information is formatted and digitized before transmitting to the controller.

3. Driver: A software program that runs on the application server and communicates with the controllers in the field and client computers.

4. IP based controller: A controller that communicates with the driver over an Ethernet network.

5. IP based sub-controller: A sub-controller that communicates with the controller over an Ethernet network.

6. Serial based sub-controller: A sub-controller that communicates with the controller via direct cabling using a serial communication standard such as RS-485.

7. Operator: A person who is authorized to login to the access control software for the purpose of monitoring activity, controlling hardware, managing credentials, or administrating the access control system.

8. Credential-holder: A person who has been issued an active credential. Usually an employee or long term sub-contractor of the owner.

C. Reference Standards

1. Institute of Electrical and Electronics Engineers (IEEE): 
   a. IEEE 1100 Recommended Practice for Powering and Grounding Electronic Equipment.

2. National Fire Protection Association (NFPA):
1.3. ADMINISTRATIVE REQUIREMENTS

A. Record Documentation
   1. Record documentation shall consist of product data, as built drawings and operations and maintenance (O&M) manuals.
   2. Prior to substantial completion testing of the Security Access Control system, submit two hard copies of the preliminary as-built drawings to the Architect for review and approval. Preliminary as-built drawings may include legible red-line markups of field changes and notes. Upon acceptance of preliminary as-built drawings and other pre-test requirements, the Owner will schedule a Substantial Completion test.
   3. Operation and Maintenance (O&M) Manuals
      a. Record documentation shall include operation and maintenance manuals for devices, equipment and software modules.
      b. Bind final copies of O&M manuals in hardback, loose-leaf binders.
      c. Identify each manual's contents and tab sheets for each O&M Manual. Furnish tab sheets at the beginning of each chapter or section and at the beginning of each appendix.
      d. Manuals shall include a list of manufacturers, their local representatives and subcontractors that performed Work on the Project with a detailed description of the Work they performed. The list shall include contact names, telephone numbers and address for each. Manufacturer product information. Theory of operation, design philosophy, and specific functions.

B. Sequencing and Scheduling
   1. The Contractor shall review the construction and completion schedules and shall coordinate execution of the Work as defined in the Contract documents with all other contractors and service providers engaged by the Owner and their representatives for the Work.

1.4. SUBMITTALS

A. Product Data
   1. Provide product data cut sheets for all listed products in section two of this specification as per Section 01 33 00 with the following provisions:
   2. Shop drawings are not required for each submittal package.
   3. Provide manufacturer cut sheets for each piece of equipment specified. Include the manufacturer name, model number and description of each listed component.
   4. Provide a copy of current manufacturer certifications.
   5. Provide a copy of the company’s state security license.
   6. No portion of the work shall commence or equipment ordered until the architect has approved the submittals.
   7. All work to be performed in accordance with approved submittals.

B. Shop Drawings
   1. System device locations on architectural floor plans
2. Full Schematic of system, including wiring for all devices.

C. Manufacturers’ Instructions

1.5. CLOSEOUT DOCUMENTS

A. Maintenance Data
   1. Include manufacturers’ operating instructions, original copies of all software, recommended maintenance required and maintenance intervals.
   2. Contractor will provide (1) One copy of full size ANSI standard drawings sets to be reviewed and approved by the owner and the architect. A CD copy of all drawings will also be provided with the close out documentation. Drawings will be issued in both CAD and PDF formats on the CD.
      a. The drawings shall accurately reflect all changes and additions to the Access Control system since the bid.

1.6. QUALITY ASSURANCE

A. Contractor Qualifications
   1. The installing Access Control system contractor shall provide proof from the manufacturer that they are an authorized integrator for the products proposed in this section.
   2. The contractor will utilize the authorized manufacturer components and distribution channels in provisioning this project. Contractors must be prepared to submit authorized manufacturer factory training certificates.
   3. The proposed contractor will have a minimum of three (3) years of recent experience with the proposed manufacturer’s products.
   4. Preferred contractor will have minimum of five (5) years’ experience with the design, installation and project management of security access and control systems.
   5. The contractor will comply with all federal, state and local statutes regarding qualifications of firms.
   6. The contractor must have previously established offices located within 180 miles of the project site.
   7. The contractor shall provide proof of licensing by the Texas Board on Private Security run by the Department of Public Safety.
   8. The contractor shall ensure compliance with and have a thorough understanding of all local codes and contract conditions pertaining to the Work.

B. Product Standards
   1. Materials included in the completed security system installation shall be new and shall fully comply with the latest published specifications and versions of the manufacturers.
   2. Unless otherwise specified, components included in the completed security system shall be standard, unmodified production models.
   3. Equipment, components and materials provided by the Contractor shall meet or exceed the performance characteristics and technical specification for the referenced components.
   4. The contractor shall provide complete and detailed technical information for equipment, components and materials. The Owner or its representative will reject proposed equipment in the event that submitted technical information is not sufficient to readily confirm that proposed equipment, components and materials will meet or exceed the performance and technical specifications. The Owner or its representatives shall make the final decision as to whether proposed equipment, components and materials are acceptable. In no case shall acceptance by the Owner or its representative of proposed equipment, components and materials relieve the Contractor of his/her responsibility to produce complete systems, which comply with this Section.
   5. The system (including software, hardware and firmware) proposed for this project shall have been installed in at least two projects of similar size and nature and shall have been in beneficial use for at least six months prior to submission of the bid proposal. Provide a compliance statement from each manufacturer along with references as part of the Bid Proposal.
1.7. DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of the delivery storage and handling specification sections in the project specification book.

B. Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.

C. Store materials protected from exposed to harmful environmental conditions and at temperature conditions recommended by the manufacturer.

D. Handle products and systems in accordance with manufacturer’s instructions.

1.8. WARRANTY

A. Provide Manufacturer’s warranty covering (1) one year from date of shipment for replacement or repair of defective equipment.

B. The Warranty shall begin after acceptance of the Work by the Owner.

C. Submit a written warranty, executed by the Contractor, Installer and Manufacturer, agreeing to repair or replace any component(s) that fail in materials or workmanship within the specified warranty period.
   1. Contractor Labor Warranty Period: One (1) year after date of Substantial Completion.
   2. Approved manufacturer. Product Warranty Period: Two (2) years after the purchase date of equipment. OEM, other equipment purchased and resold by the approved manufacturer, shall carry only the warranty given by the original manufacturer and is not covered by the approved manufacturer’s warranty.

D. Contractor will provide warranties for all manufacturers’ equipment used in this installation.

E. Additional Warranty
   1. Contractor will state any additional Contractor supplied warranty.

PART 2 PRODUCTS

2.1. SYSTEM DESCRIPTION

A. Manufacturers
   1. Manufacturer List
      a. Open Options, Inc. 3440 Sojourn Drive Suite 240 Carrollton TX 75006 (972) 818-7001
      b. DSX Access System Inc. Dallas, TX
      c. MAXxess System Inc. Anaheim, CA
      d. Lenel Systems International Inc. Rochester, NY
   2. Substitution Limitations
      a. The Model numbers used are those of DNA Fusion Open Options, Inc. Carrollton, Texas. This shall constitute the quality and performance of the equipment to be furnished. The Manufacturers’ listed above are acceptable building access system manufacturers; any other proposed suppliers must be pre-approved.

B. Description
   1. The Access Control System (ACS) shall consist of all required hardware and software including but not limited to server(s), access control management software, data exchange software, credential
management software, data gathering panels, network interface devices, door position switches, request to exit devices, keypads, electric locking mechanism interfaces, power supplies and other input and output devices.

a. All controllers and sub-controllers will be UL 294 listed assemblies.

2. Locate ACS equipment including, but not limited to data gathering panels, power supplies, networked interface devices, etc. within key-lockable cabinets with tamper switches. Provide standard keys for all cabinets.

3. Keypad Controlled Doors (Coordinate with Owner if keypad or card readers are preferred)
   a. Provide keypad, system workstation, and time schedule control of electric locking mechanisms.
   b. Interface to electric locking mechanisms and power transfer devices provided under a separate section.
   c. Interface electric locking mechanisms to the Fire Alarm system for fail-safe release where required by code.
   d. Provide one door position switch in each controlled leaf of a keypad controlled door. Program the keypad controlled door to automatically relock when the door opens.
   e. Provide one request-to-exit device in the interior space of a credential controlled door. Program the keypad controlled door to automatically unlock when the request-to-exit device is activated and to relock when the door opens. Program the access control system to unlock the door for a preprogrammed time upon activation of the request-to-exit.

4. Software and Server
   a. Provide all licenses and software required to operate system.
      1) Furnish all sub-controller licenses required for this installation. Minimum of 10 sub-controllers licenses required.
      2) DNA SC10 DNA Fusion Software.
   b. Provide an application server that exceeds the following minimum specifications:
      1) Multi-Core Processor speed 2.4 GHz
      2) System Memory 4GB
      3) 10/100 Ethernet Networking Card
      4) Hard drive(s) with 250 GB storage space
      5) VGA support for 1024x768 resolution
      6) Video memory 128MB
      7) CD/DVD drive with read/write capability
      8) Windows Server 2003 or 2008
      9) Universal Power Supply (UPS)

C. Performance / Design Criteria
   1. Capacities -
      a. Maximum controllers per driver: 256
      b. Maximum sub-controllers per controller: 32
         1) This number varies per model of controller.
         2) Some controller models may have a smaller number for maximum sub-controllers.
      c. Maximum doors per controller: 64
         1) This number varies per model of controller.
         2) Some controller models may have a smaller number for maximum doors
      d. Maximum pin digits: 15
      e. Maximum card formats per controller: 8
      f. Maximum time zones per controller: 255
      g. Maximum holidays per controller: 255

   2. System Requirements
      a. Access Control System Hardware
         1) Access control hardware must not be proprietary.
         2) Support Mercury Security Corporation controllers and sub-controllers.
         3) Support Schlage AD-Series electronic locks.
4) Support credential readers that communicate via wiegand or clock and data communication formats
5) Support credential readers that communicate via Open Supervised Device Protocol (OSDP)
6) Support credential printers that are shipped with Microsoft Windows drivers designed for the supported operating systems.
7) All controllers, sub-controllers and electronic locks will be in continuous communication with the access control system. Offline devices that require intermittent communication will not be acceptable.
8) A sufficient number of controllers will be provided to monitor all credential reader locations shown on plan.
9) Controllers and sub-controllers will be Authentic Mercury.

b. Access Control System Software will provide the following required features:
1) Support the following operating systems:
   a) Microsoft Windows Vista Ultimate, Business and Enterprise editions
   b) Microsoft Windows 7 Professional and Ultimate editions
   c) Microsoft Windows Server 2003 Standard, Enterprise and Datacenter editions
   d) Microsoft Windows Server 2008 Standard, Enterprise and Datacenter editions
2) Support for both 32 bit and 64 bit operating systems.
3) Support for operating in a virtual machine environment.
4) Support for the following database products:
   a) Microsoft SQL Server 2005 Express, Workgroup, Standard and Enterprise editions
   b) Microsoft SQL Server 2008 Express, Workgroup, Standard and Enterprise editions
5) Prevent operators from accessing the database with third party applications.
   a) This feature will be inherent to the access control application.
   b) This feature will be controlled through windows permissions.
   c) Use of third party “Single Sign-on” solutions to meet this requirement will not be acceptable.
6) The driver will operate as a windows service.
   a) A windows user will not be required to login and leave the server unattended for continued operation of the driver.
7) Support for both thick and thin clients is required.
8) Context sensitive reporting
   a) Users will be able to right click on an object (person, door, credential, etc.) and view reports relevant to the object.
   b) For example, right clicking on a door allows the user to select and view the following reports:
      • History of activity at the identified door
      • List of credential holders who have access to the identified door
      • Door status
9) Filter events displayed by dragging a door or person to the events grid.
10) Configure a door to follow a time schedule by right clicking on the door.
11) View access levels assigned to a credential by hovering the mouse over the credential.
12) Assign access levels to credentials, people or groups of people using drag and drop.
13) Integrate with a Video Management System (VMS) allowing:
   a) Control of doors from the VMS client software.
   b) Display of events in the VMS client software.
   c) Send event and alarm data to VMS to allow for start and stop of recording or change in frame rate.
14) Capable of assigning multiple credentials per single personnel record.
15) Allows access levels to expire based on a date-time value.
16) Capable of enforcing two-man rule before granting access
17) Allows use of threat levels to alter system behavior.

D. Data Gathering Panel
1. Provide the following Open Options, Inc. controllers as required to provide for keypad control of doors:
   a. Controllers E2-SSP-EP or E2-SSP-D2 as required.
   b. Sub-Controllers E3-2RSC-2, E3-2RSC-2 or E3-2RSC1 as required.
   c. Input and Output Sub-Controllers E3-2ISC-16, E3-2OSC-16 or E3-ISC-16-OSC-16 as required.

2.2. ACCESSORIES

A. Power Supplies
   1. Provide the following Open Options, Inc. power distribution units as required to provide for keypad control of doors.
      a. Power Distribution Unit (PDU) – 8
      b. Power Distribution Unit (PDU) – 16
   2. Provide battery chargers for all power supplies. Provide batteries for all power supplies as required to provide a minimum of 4 hours of battery backup for a fully loaded power supply, regardless of connected load.
   3. Provide for monitoring power supplies as follows:
      a. Monitor secondary output voltage of power supply to annunciate power failures.
      b. Monitor batteries to annunciate low battery and battery failure conditions.
      c. Provide power distribution boards with independently fused outputs for each connected device.
   4. Minimum Specifications
      a. UL Listed UL294, Power Limited Power Supply
      b. 120VAC input voltage
      c. Output rating of 150% of the actual connected load.
      d. Individual low battery and power fail alarm outputs.
      e. Key lockable steel enclosure with tamper switch. Key all power supplies alike and on the same key as other Access Control System cabinets.

B. Keypad (Coordinate with Owner if keypad or card readers are preferred)
   1. Provide XceedID Multi-Technology MTMSK15 readers.
   2. Electrical Contractor to provide a conduit and single gang back box for each reader location.
      a. All readers will be flush mounted to the exterior or interior wall as shown.
      b. Contractor will seal all exterior mounted reader locations with a clear UV resistant sealant to prevent insect and water damage. Silicon should dry clear and must be UV resistant.
      c. Route the wiring to the nearest access control panel.

C. Door Position Switches
   1. Provide GE-Interlogix 1078W wide gap recessed door position switches to monitor the open/closed status of the doors.
   2. Provide GE-Interlogix 2505A industrial wide gap door position switches to monitor the open/closed status of gates, latches and doors.
   3. Provide GE-Interlogix 2202A Series floor mounted door position switches to monitor the open/closed status of overhead doors.

D. Request to Exit Devices
   1. Provide (REX) request-to-exit devices at doors that do not have integrated switches within the locking devices provided by the Finish Hardware in Section 00 87 10.
   2. Some doors that do not open into the building but into stand-alone type rooms such as riser, mechanical, electrical etc. will not require (REX) devices unless they are specifically called out on the drawings or the door hardware schedule.
   3. Provide Bosch DS160 request-to-exit PIR device as required.
2.3. SYSTEM REQUIREMENTS, CABLE AND INSTALLATION

A. System Requirements
1. Provide all control cabling for all REX devices, door position switches, power supplies, keypads and electric locking devices as required to provide a complete and functioning system.
2. Refer to the drawings for any locations of the devices and connect them into the access control panel. All devices shown on the drawings will be considered a monitored device.
3. All cabling for the approved manufacturer's hardware must meet the factory specifications, including the requirement for cable that is stranded, twisted, with an overall shield to eliminate electrical interference.
4. Pair counts and wire gauge must meet the approved manufacturer's specifications based upon the distances and power level required.
5. All cabling installed for this system will be supported with j-hooks secured to the building structural steel, walls, or by dedicated all thread rods or dedicated grid wire. Do not share pathways with any other low voltage structured cable plant and will not use the grid wire that is supporting the ceiling at any time.
   a. Do not secure j-hooks to the ceiling grid wire for any reason. Grid wire may be used to support independent j-hooks providing it is properly secured to the building structure. J-hooks will be spaced 48” to 60” apart.
6. Cable pathways will not rest or be secured to ducts, pipes or other utilities found in the overhead ceiling. Pathways not conforming to these requirements will be replaced or repaired by the contractor immediately.
7. Any cables showing signs of excessive bending or mishandling that result in damage to the cable jacket will be replaced at contractor's cost.
8. Cable will be installed for a plenum environment.
9. Provide sleeves as needed to penetrate any walls and fire stop the sleeves to meet all applicable codes. It will be the Contractor's responsibility to plan for any such penetrations. All penetration will require sleeves and will be fire stopped to meet local and national codes.

B. Installation
1. Install equipment and software in accordance with manufacturers' requirements and instructions.
2. Verify exact mounting locations of equipment with the Architect and owner prior to installation.
3. Provide tamper resistant fasteners for equipment located in public areas.
4. Label all terminals, connectors and cables using a permanent method such as self-laminating marking tape.
5. Identify label names on record documents.
6. Provide silk-screened, engraved and filled, or engraved plastic laminate labels for visible panels and controls.
7. Wiring color codes will be strictly observed and terminations will be uniform throughout the system.
8. Components of the system will be installed in a neat and professional manner.
9. All cables shall have 6 foot service loop neatly coiled in accessible ceiling.
10. Coordinate exact panel and power supply mounting locations with Electrical Contractor.

C. Cables
1. All cable shall be CMP rated for installation in plenum ceiling.
2. Low voltage power and control point cables shall be minimum 18 AWG conductors, twisted, stranded, insulated and jacketed.
3. Alarm point monitoring and data cables shall be minimum 20 AWG conductors, twisted, stranded, insulated and jacketed.
4. Keypad reader cables shall be minimum 20 AWG conductors, twisted, stranded, insulated and jacketed.
5. Acceptable manufacturers or equal.
PART 3 EXECUTION

3.1. INSTALLERS

A. Installers must be an authorized distributor recognized by the manufacturer.

B. Installers shall be a certified installer and properly licensed to install, modify and service the specified systems.

C. Installers shall have a minimum of five (5) years’ experience in the fabrication, assembly and installation of systems of similar complexity as specified herein.

3.2. COORDINATION

A. Coordination with Owner
   1. Programming information required to interface systems with Owner.
   2. Final device locations and installation and operational requirements.
   3. Equipment labeling.
   4. Training curriculum, syllabus and schedule.

B. Coordination with Architect
   1. Equipment finishes and colors. Submit finishes and graphics for equipment in public areas to the Architect for approval prior to installation.
   2. Locations of all devices prior to installation.

C. Coordination with General Contractor
   1. Verify that adequate conduit is provided and that equipment back boxes are adequate for system installation.
   2. Verify that adequate power has been provided and properly located for the security system equipment. Coordinate circuit, breaker and panel locations and identify locations in record documents.
   3. Verify that doors and door frames are properly prepared for electric locking hardware and door position switches.

3.3. TRAINING

A. Provide training as follows:
   1. Administrator Training
      a. Provide training for a minimum of four (4) administrative staff.
      b. Training shall include configuration, administration and use of system and system integration.
   2. Console operator Training
      a. Provide training for a minimum of four (4) console operators in minimum of 2 separate training sessions.
      b. Training shall include use of the system and systems integration within the Security Control Center.
   3. Operator Training
      a. Provide training for a minimum of four (4) system operators in minimum of 2 separate training sessions.
b. Training shall include use of systems and systems integration outside the Security Control Center.

B. Coordinate training schedules and syllabi with the Owner

3.4. TECHNICAL SUPPORT

A. On site move day support
   1. Provide technical support at such levels and at such times as the Owner deems necessary during the physical move to the site.

B. The personnel providing technical support will have thorough and in-depth knowledge of the system and materials that were used as well as have direct project experience.

3.5. SYSTEM START UP

A. System shall be complete and ready to operate prior to final acceptance testing.

B. Program and set-up the system as specified and directed by the Owner. Coordinate procedural guidelines and programming and set-up information with the Owner prior to programming the system.

3.6. FINAL ACCEPTANCE

A. The contractor will perform on-going reviews of all work for compliance with the contract documents with a representative from the Architect. All work will be performed in a high quality manner and the overall appearance will be clean, neat and orderly.

B. The following is a partial list of items that will be examined and will comply satisfactorily in all instances during the final acceptance process.
   1. Is cable plant properly installed as per these specifications?
   2. Do all pathway methods and materials meet established pathway standards?
   3. Are all pathway penetrations properly fire stopped?
   4. Is all labeling inside the control panels machine generated?
   5. Verify all keypad are correctly operating and reporting.
   6. Has the system been programmed with all the features per the Owner?
   7. Have all record documents and drawings been transmitted to the Owner through the GC and reviewed and approved by the Architect.

END OF SECTION
SECTION 31 20 00
EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Excavating and backfilling for sidewalks, curbs, and ramps where indicated on the Drawings.
   2. Excavating and backfilling for underground mechanical utilities.
   3. Site grading.
   4. Asphalt paving.

B. Related Sections:
   1. Division 1: Administrative, procedural, and temporary work requirements.
   2. Section 01 23 00 – Alternates for repaving east and west lots and ADA parking at north entry.
   3. Section 32 16 23 – Portland Cement Concrete Paving for sidewalks, curbs, and ramps.
   4. Section 32 92 23 – Sodding for site restoration.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
B. C 136 - Sieve Analysis of Fine and Coarse Aggregates.
C. D 698 - Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3) (600 kN-m/m3).
D. D 2922 - Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth).
E. D 4254 - Minimum Index Density of Soils and Calculation of Relative Density.

1.3 DEFINITIONS

A. Excavation consists of the removal of material encountered to subgrade elevations and the reuse or disposal of materials removed.
B. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
C. Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavations.
D. Select Fill: The layer of compacted fill materials placed between the subgrade and surface slab in a soil-supported foundation.
E. Structures: Buildings, footings, foundations, retaining walls, slabs, curbs, mechanical and electrical appurtenances, or other manmade stationary features constructed above or below ground surface.
F. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within building lines.
G. Backfill Materials: Satisfactory soil materials free of clay, rock, or gravel larger than 2 inches in any dimensions, debris, waste, frozen materials, vegetation and other deleterious matter.
1.4 SUBMITTALS

A. Test Reports: In addition to test reports required under Quality Requirements, submit the following:
   1. Laboratory analysis of each soil material proposed for fill and backfill from on-site and borrow sources.

1.5 QUALITY ASSURANCE

A. Codes and Standards: Perform earthwork complying with requirements of authorities having jurisdiction.
   1. Comply with Trench Safety requirements established by OSHA.
B. Pre-installation Conference: Before commencing earthwork, meet with representatives of the governing authorities, Owner, Architect, consultants, independent testing agency, and other concerned entities. Review earthwork procedures and responsibilities including testing and inspection procedures and requirements. Notify participants at least 3 working days prior to convening conference. Record discussions and agreements and furnish a copy to each participant.

1.6 PROJECT CONDITIONS

A. Existing Services:
   1. General: Indicated locations are approximate; determine exact locations before commencing work. Determine location of above grade and underground utilities and perform work in a manner, which will avoid damage. Hand excavate, as required.
   2. Maintain all existing underground utilities. Locate existing underground utilities in areas of excavation work. Provide adequate means of support and protection during earthwork operations. Coordinate with utility companies to temporarily shut off services during excavation if lines are active.
   3. Traffic: Conduct site-clearing operations to ensure minimum interference with driveways, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks, or other occupied or used facilities without permission from Owner.

1.7 SITE PROTECTION

A. Protection of Persons and Property: Barricade open excavations occurring as part of this work.
B. Protection of Existing Elements: Provide protections necessary to prevent damage to existing elements indicated to remain in place.
   1. Restore damaged elements to their original condition, as acceptable to Owner at no additional cost to Owner.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide approved borrow soil materials from off-site when sufficient approved soil materials are not available from excavations.
B. Backfill: Reused site soils free from trash, debris, roots over 1 inch in diameter, matted roots, rocks over 3 inches in diameter, topsoil, and other deleterious matter.
C. Drainage Fill: Crushed stone or gravel, graded as follows per ASTM C 136:
### SIEVE SIZE

<table>
<thead>
<tr>
<th>SIEVE SIZE</th>
<th>PERCENT PASSING</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1/2 inches</td>
<td>100</td>
</tr>
<tr>
<td>1 inch</td>
<td>95 - 100</td>
</tr>
<tr>
<td>3/4 inch</td>
<td>55 - 85</td>
</tr>
<tr>
<td>1/2 inch</td>
<td>25 - 50</td>
</tr>
<tr>
<td>No. 4</td>
<td>0 - 5</td>
</tr>
</tbody>
</table>

### D. Import Topsoil
Contractor to supply high quality imported topsoil of loamy character, high in humus and organic content from local agricultural source. Topsoil to be reasonably free from clay lumps, coarse sands, stones, roots, and other foreign matter. There shall be no toxic amounts of acid or alkaline elements.

#### 2.2 ASPHALT PAVING

A. General: Use locally available materials and gradations that exhibit a satisfactory match to adjacent installations.

B. Base and paving materials shall comply with State of Texas Department of Transportation Standard Specifications.
   1. Surface course: Type D.
   2. Base course: Type B.

#### 2.3 ACCESSORIES

A. Detectable Warning Tape: Acid and alkali resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick minimum, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 2'-6" deep.
   1. Tape Colors: Provide tape color to utilities as follows:
      a. Red: Electric
      b. Yellow: Gas, oil, steam, and dangerous materials
      c. Orange: Telephone and other communications.
      d. Blue: Water systems.
      e. Green: Sewer systems.

### PART 3 - EXECUTION

#### 3.0 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damaged caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Provide erosion control measures to prevent erosion of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Cut roots of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction. Cuts shall be made with a rock saw or manually cut to create a clean edge. No backhoes are allowed for trenching due to the high potential for damage to root structure of existing trees.
1. Leave existing topsoil in place within drip lines of existing trees to prevent damage to root system.

3.2 DEWATERING

A. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding areas.

B. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

3.3 EXCAVATION

A. General

1. Explosives: Do not use explosives.

2. Unclassified Excavation: Excavation is unclassified and includes excavation to required subgrade elevations regardless of the character of materials and obstructions encountered.
   a. Unclassified excavation includes excavation of walks, pavements and other obstructions visible on surface; underground structures, utilities, and other items indicated to be demolished and removed; together with soil and other materials encountered that are not classified as rock or unauthorized excavations.

B. Stability of Excavations

1. Comply with OSHA requirements, local codes, ordinances, and requirements of authorities having jurisdiction to maintain stable excavations. Stability of excavations shall be the responsibility of the Contractor.

2. Shoring and Bracing: Provide and install shoring and bracing as legally required. Shoring design shall be provided by the Contractor and prepared by a Professional Engineer registered in the State of Texas.

C. Excavation Adjacent to Existing Structures: Exercise caution in excavation adjacent to existing structures. Do not excavate beneath existing foundations unless indicated to do so. Comply with requirements indicated to prevent undermining of existing foundations.

D. Excavation for Walks and Pavements: Excavate surfaces under walks and pavements to indicated cross sections, elevations and grades.

E. Excavation for Utility Trenches:

1. Excavate trenches to indicated slopes, lines, depths, and invert elevations.

2. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicate.
   a. Clearance: As indicated.

3. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove stones and sharp objects below invert elevation and install bedding course.
   a. For pipes or conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.

   b. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
3.4 **UNAUTHORIZED EXCAVATIONS**

A. Fill unauthorized excavation under foundations or wall footings by extending indicated bottom elevation of concrete foundation or footing to excavation bottom, without altering required top elevation.

1. In locations other than those above, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Architect/Engineer.

3.5 **STORAGE OF SOIL MATERIALS**

A. Stockpile excavated materials acceptable for backfill and fill soil materials, including acceptable borrow materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

3.6 **DRAINAGE FILL**

A. Place drainage fill to profiles and elevations indicated.

B. Place fill in maximum 6 inch deep, even, horizontal lifts.

C. Compact each lift to minimum 90 percent of ASTM D 4254 relative density.

3.7 **BACKFILL**

A. Backfill excavations promptly, but not prior to completing the following:

1. Acceptance of construction below finish grade including, waterproofing, subsurface drainage, and window well construction.

2. Surveying locations of underground utilities for record documents.

3. Testing, inspection, and approval of underground utilities.

4. Concrete formwork removal.

5. Removal of trash and debris from excavation.


B. Utility Trench Backfill

1. Place and compact bedding course on rock and other unyielding bearing surfaces and to fill unauthorized excavations. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

2. Place and compact initial backfill of satisfactory soil material or subbase material, free of particles larger than 1 inch, to a height of 12 inches over the utility pipe or conduit.

   a. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility systems.

3. Coordinate backfilling with utilities testing.

4. Fill voids with approved backfill materials as shoring and bracing, and sheeting is removed.

5. Place and compact final backfill of satisfactory soil material to final subgrade.

6. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

C. Subbase and Base Courses:

1. Under pavements and walks, place subbase course material on prepared subgrades. Place base course material over subbases to pavements.

   a. Compact subbase and base courses at optimum moisture content to required grades,
lines, cross sections and thickness to not less than 95 percent of ASTM D 4254 relative density.

b. Shape subbase and base to required crown elevations and cross-slope grades.

c. When thickness of compacted subbase or base course is 6 inches or less, place materials in a single layer.

d. When thickness of compacted subbase or base course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.

D. Fill

1. Preparation: Remove vegetation, topsoil, debris, wet and unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placing fills.

a. Plow strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing surface.

b. When subgrade or existing ground surface to receive fill has a density less than that required for fill, break up ground surface to depth required, pulverize, moisture-condition or aerate soil and re-compact to required density.

2. Place fill materials in layers to required elevations for each location listed below.

a. Under grass, use new import topsoil.

b. Under landscape beds, use new import topsoil.

c. Under walks and pavements, use subbase or base material, or satisfactory excavated or borrow soil material.

d. Under footings and foundations, use engineered fill.

3.8 MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice

2. Remove and replace, or scarify and air-dry satisfactory soil material that is too wet to compact to specified density.

a. Stockpile or spread and dry removed wet satisfactory soil material.

3.9 COMPACTION

A. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill materials evenly on all sides of structure to required elevations. Place backfill and fill uniformly along the full length of the structure.

C. Percentage of Maximum Dry Density Requirements: Compact soil to not less than the following percentages of maximum dry density according to ASTM D698:

1. Under structures, building slabs, steps, and pavements, compact the top 12 inches below subgrade and each layer of backfill or fill material at 95 percent maximum dry density.

2. Under walkways, compact the top 6 inches below subgrade and each layer of backfill or fill material at 95 percent maximum dry density.

3. Under lawn or unpaved areas, compact the top 6 inches below subgrade and each layer of backfill or fill material at 90 percent maximum dry density.

4. Select Fill shall be placed in lifts not to exceed eight inches loose thickness and compacted to between ninety-five percent and one hundred percent of the maximum dry density as determined by ASTM D698.
3.10 ASPHALT PAVING

A. Remove the existing pavement and existing compacted base course material as necessary. Remove the existing base course material that has deteriorated and cannot be reused; stockpile material on site that can be reused.

B. Remove earth/stone to the required subgrade level needed to connect utilities.

C. After utility connections have been installed, tested and approved by local authorities, backfill and compact per State of Texas Department of Highways and Public Transportation Standard Specifications.

D. Placing Mix
   1. General: Comply with the requirements of the State of Texas Department of Highways and Public Transportation Standard Specifications.
   2. Patching: Cut out areas and fill with fresh, hot-mixed asphalt. Match thickness of adjoining asphalt. Compact by rolling to surface density and smoothness specified by TXDOT.
   3. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
   4. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.11 SITE GRADING

A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
   1. Provide smooth transition between existing adjacent grades and new grades.
   2. Cut out soft spots, fill low spots, and trim high spots to conform to required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
   1. Lawn or Unpaved Areas: Plus or minimum 0.10 foot.
   2. Walks: Plus or minus 0.10 foot.
   3. Pavements: Plus or minus ½ inch.

3.12 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction due to subsequent construction operations or weather conditions.
   1. Scarify or remove and replace material to depth directed by the Architect; reshape and recompact at optimum moisture content to the required density.

C. Settling: Where settling occurs during the Project correction period, remove finished surfacing, backfill with additional approved material, compact, and reconstruct surfacing.
   1. Restore appearance, quality and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.13 FIELD QUALITY CONTROL

A. Testing Laboratory Services: Perform field in place density tests, ASTM D 2922, at following rates; minimum of three tests for each lift or area:
1. Under paving: One test for each 5000 square feet or fraction thereof, per lift.
2. Trenches and below grade walls: One test for each 100 linear feet, per lift.

3.14 CLEANING
   A. Remove surplus materials and those not suitable for reuse from site.

3.15 PROTECTION
   A. Protect graded areas from traffic and erosion; keep free of trash and debris.

END OF SECTION
SECTION 02754
PORTLAND CEMENT CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Concrete curbs, gutters, walks, and curb ramps.

B. Related Sections:
   1. Division 1: Administrative, procedural, and temporary work requirements.
   2. Section 07920 - Joint Sealers.

1.2 REFERENCES

A. American Concrete Institute (ACI) 301 - Specifications for Structural Concrete for Buildings.

B. American Society for Testing and Materials (ASTM):
   1. A 185 - Welded Steel Wire Fabric for Concrete Reinforcement.
   2. A 615 - Deformed Billet Steel Bars for Concrete.
   3. C 33 - Concrete Aggregates.
   9. C 494 - Chemical Admixtures for Concrete.
   10. D 1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

C. Concrete Reinforcing Steel Institute (CRSI) - Manual of Practice.

1.3 SUBMITTALS

A. Mix Designs: Include:
   1. Materials and proportions.
   2. Aggregate gradations.
   3. Water/cement ratio, design strength, slump, and air content.
   4. Admixtures.
   5. Special requirements.

1.4 QUALITY ASSURANCE

A. Concrete Mix Design: ACI 301, Method 2.

1.5 DELIVERY, STORAGE AND HANDLING

A. Mix and deliver concrete to project in accordance with ASTM C 94.

B. Schedule delivery so that continuity of any pour will not be interrupted for over 15 minutes.
C. Place concrete on site within 90 minutes after proportioning materials at batch plant.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Formwork:
   1. Forms: Wood, metal, or other material that will not adversely affect surface of concrete and will provide specified surface finish.
   2. Form release agent: Nonstaining, wax barrier type.

B. Reinforcement:
   1. Reinforcing bars: ASTM A 615, deformed, Grade 40 or 60.
   4. Accessories: Include devices necessary for placing, spacing, supporting, and fastening reinforcement.
   5. Tie wire: Black annealed steel, 16 gage minimum.

C. Concrete Materials:
   1. Portland cement: ASTM C 150, Type I or III as applicable.
      a. Fine: Natural sand free from silt, loam, and clay.
      b. Coarse: Crushed, stone, maximum size No. 467.
   3. Admixtures:

D. Expansion Joint Filler: Non asphaltic type, ASTM D 1752, Type 1.

E. Joint Sealers: Specified in Section 07920.

F. Curing Materials:
   2. Curing paper: ASTM C 171, waterproof paper or polyethylene film.

G. Water: Clean and potable.

H. Sandblasting Aggregate (As necessary to match existing adjacent finishes): Natural or manufactured.

2.2 MIXES

A. Proportions: Proportions of cement, aggregate, and water to attain required plasticity and compressive strength shall be in accordance with ACI 301.

B. Design concrete to yield following characteristics:
   1. Minimum 28 day compressive strength: 3000 PSI.
   2. Slump: 3 to 5 inches.
   3. Air entrainment: 4 to 6 percent.
2.3 FABRICATION
   A. Reinforcing: In accordance with CRSI Manual.

PART 3 - EXECUTION

3.1 CONSTRUCTION OF FORMWORK
   A. Set accurately to required grades and alignment.
   B. Brace to withstand loads applied during concrete placement.
   C. Clean contact and screed surfaces of hardened concrete and foreign materials.
   D. Apply form release agent to contact surfaces.
   E. Leave in place minimum 12 hours after completion of finishing operation.
   F. Provide expansion joints where paving abuts existing and other construction, and at maximum 30 feet on center unless otherwise indicated.
      1. Shape joint filler to concrete cross section and fasten in place. Provide holes for dowel bars maximum 1/8 inch larger than bar diameter.
      2. Use removable strips to provide recess for sealant.

3.2 INSTALLATION OF REINFORCEMENT
   A. In accordance with ACI 301 and CRSI Manual.
   B. Before placing, clean reinforcing of loose rust, mill scale, dirt, oil, and other materials that could reduce bonding.
   C. Install wire fabric in longest practical lengths. Offset end laps in adjacent widths to prevent continuous lap.
   D. Install reinforcing in middle third of flatwork.
   E. Stop alternate bars of reinforcing steel at control joint locations.
   F. Provide dowels at maximum 12 inches on center at expansion joints; stop reinforcement on both sides of joint.

3.3 CONCRETE PLACEMENT
   A. Place concrete in accordance with requirements of ACI 301.
   B. Avoid segregation due to rehandling or flowing.
   C. Do not place partially hardened, contaminated, or retempered concrete.
   D. Consolidate with mechanical vibrating equipment.
   E. Before depositing new concrete on concrete that has set, roughen and clean surface of set concrete. Wet surfaces just prior to placing new concrete.
   F. Locate temporary interruptions of concrete placement at either an expansion or control joint.
G. Shape curbs and gutters to required cross section by use of template.

H. Strike off flatwork with transverse screed, shaped to provide slope where required, guided by screeds or side forms. Follow screeding operation with longitudinal float.

I. Tool expansion joint edges and other exposed edges to smooth, dense surface with 1/8 inch radius.

J. Control Joints:
   1. Walks: Provide control joints at maximum 5 feet on center unless otherwise indicated. Form joints straight and of uniform depth, using 3/8 inch deep round edge tool.

K. Protect concrete from frost damage and rapid drying; use curing paper or curing compound method.

L. Installation Tolerances: Surfaces true to plane, in longitudinal direction to required grade, within plus or minus 1/4 inch in 10 feet, noncumulative.

M. Seal expansion joints as specified in Section 07920.

3.4 CONCRETE FINISHING

A. Sandblasted Finish (For exterior walks): Sandblast exposed surfaces to uniform medium texture as required to match existing adjacent finish.

B. Broomed Finish with Troweled Grooves (For curb ramps): Apply non-slip broomed finish with smooth troweled grooves complying with Texas Accessibility Standards (TAS).

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Parking stall striping on concrete or asphalt, including handicap parking stall symbol and striping at accessible aisle.

B. Related Sections:
   1. Division 1: Administrative, procedural, and temporary work requirements.
   2. Section 01 23 00 – Alternates for repaving east and west lots and ADA parking at north entry.
   3. Section 32 11 00 – Plant Mix Bituminous Pavements for asphalt paving.

1.2 PROJECT CONDITIONS

A. Do not apply paint when rain or excess humidity are present, ambient or pavement temperature is below 40 degrees F, nor when such conditions are anticipated within 8 hours after application.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Painting on Asphalt:
   1. Type: Chlorinated rubber, Alkyd, Vinyl-latex emulsion, non-bleeding, formulated specifically for painting in vehicular traffic areas.
   2. Colors:
      b. Accessible parking emblems and paths: In accordance with applicable accessibility code.
      c. Fire lane designations: Red with white copy.

2.2 EQUIPMENT

A. Application Equipment: Pressurized, selfcontained, capable of applying straight line from 2 to 6 inches wide with consistent coverage at required rate.

PART 3 – EXECUTION

3.1 PREPARATION

A. Allow paving to cure minimum time recommended by paint manufacturer prior to applying paint.

B. Clean paving of grease, oil, and loose and foreign matter that could impair adhesion.

C. Remove curing compound from new concrete by lightly sandblasting. Minimize sandblasting of surfaces not receiving paint.

D. Locate markings according to drawings, using guide lines and templates.
3.2 APPLICATION
   A. Apply paint by machine at rates recommended by manufacturer.
   B. Apply paint in one coat.
   C. Provide 4 inch wide parking stall stripes unless otherwise indicated.

3.3 PROTECTION
   A. Close areas to traffic until paint is fully cured.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sod installation for restoration of site where indicated on the Drawings and where affected by the work of this Project.
   2. Fertilizing.

B. Related Sections:
   1. Division 1: Administrative, procedural, and temporary work requirements.
   2. Section 31 20 00 – Earthwork for site grading and trenching for below grade utility lines.

1.2 REFERENCES

A. American Sod Producers Association (ASPA) - Guideline Specifications to Sodding.


1.3 SUBMITTALS

A. Submit certification for grass species and sod source.

1.4 QUALITY ASSURANCE

A. Sod: Minimum age of 18 months, with root development that will support its own weight without tearing, when suspended vertically by holding upper two corners.

B. Sod Producer: Company specializing in sod production and harvesting with minimum 3 years experience, and certified by the State of Texas.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver sod on pallets. Protect exposed roots from dehydration.

B. Do not deliver more sod than can be installed within 24 hours.

C. Deliver fertilized in waterproof bags showing weight, chemical analysis, and name of manufacturer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Sod:
   1. ASPA approved, field grown grade; cultivated grass sod, strong fibrous root system, free of stones, burned or bare spots; containing no more than 10 weeds per 1000 square feet.
   2. Species: Match existing.
2.2 ACCESSORIES
   A. Fertilizer: FS O-F-241, recommended for grass.
   B. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of grass.

2.3 HARVESTING SOD
   A. Machine cut sod and load on pallets in accordance with ASPA Guidelines.
   B. Cut sod in area not exceeding 1 square yard, with minimum 1/2 inch and maximum 1 inch topsoil base.

PART 3 - EXECUTION

3.1 PREPARATION
   A. Prepare subsoil; eliminate uneven areas and low spots.
   B. Remove foreign materials and undesirable plants and their roots. Do not bury foreign material beneath areas to be sodded.
   C. Remove contaminated topsoil.

3.2 LAYING SOD
   A. Moisten prepared surface immediately prior to laying sod.
   B. Lay sod within 24 hours after harvesting to prevent deterioration.
   C. Lay sod tight without open joints and without overlapping; stagger end joints 12 inches minimum. Do not stretch sod pieces.
   D. Lay smooth.
   E. Place top elevation of sod 1/2 inch below adjoining paving.
   F. Immediately after installation, roll sod to ensure bond between sod and soil and to remove air pockets, voids, and minor depressions and irregularities.
   G. Fill voids between sod pieces with topsoil. Rake excess topsoil into sod but do not smother grass with topsoil.

3.3 WATERING
   A. Water sodded areas within 2 hours after installation, to saturation.
   B. Continue watering daily using less water; ensure moisture to 4 inch depth but avoid standing water.
   C. When root growth is observed by lifting corners of sod, reduce watering to alternating days.
   D. After 12 to 14 days, if root growth prevents sod corners from being lifted, allow sod to dry to permit mowing.
3.4 MAINTENANCE

A. Maintain lawn areas by watering, mowing, and weeding from date of installation until Substantial Completion.

B. Water to minimum depth of 2 inches; provide temporary hoses and sprinklers for non-irrigated areas.

C. Mow weekly after grass reaches 2 inch height. Neatly trim edges.

D. Remove clippings immediately after mowing and trimming.

E. Remove weeds and foreign grass weekly. Use herbicides only if approved by Architect.

3.5 FERTILIZING

A. After first mowing, apply fertilizer in accordance with manufacturer's instructions.

B. Lightly water to aid in dissipation of fertilizer.

END OF SECTION
### LEGEND:

**GENERAL ABBREVS.:**
- H: Historic
- N/H: Non-Historic
- X: Missing/Damaged Beyond Repair
- -: Not Applicable

**HARDWARE ABBREVS.:**
- DB: Deadbolt
- DS: Door Stop
- HG: Hinges
- THW: Transom Hardware
- THG: Transom Hinges
- K: Knob (Historic)
- T: Threshold
- W: Weatherstripping
- ES: Escutcheon
- SP: Strikeplate
- ML: Mortise Lock

**GENERAL NOTES:**

1. Perform work indicated on door survey.
2. Repair door and frame at removed and abandoned hardware locations. At contractor's option, replace door assembly entirely at no additional cost to the Owner.
3. Replace broken or missing glass. At exterior doors remove glass from transoms. Salvage glass in good condition for reinstallation. Replace glazing and back bedding sealant 100%.
4. Replace door hardware 100% U.O.N., refer to Door Schedule on Sht. A5.01 and Spec. Sect. 08 71 00 - Door Hardware for hardware sets.
5. Remove signage including adhesive and tapes.
7. Adjust doors and hardware to allow for proper operation, closing, and locking.

**NOTE:** THIS SURVEY DOCUMENTS EXISTING CONDITIONS. REFERENCE DOOR SCHEDULE (A5.01) AND SPECIFICATIONS FOR FULL SCOPE OF WORK.
### Detailed Door Inventory

**MILAM COUNTY ANNEX, CAMERON, TX**

<table>
<thead>
<tr>
<th>FLOOR</th>
<th>ROOM #</th>
<th>EXISTING DOOR HARDWARE:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>TYPE:</td>
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<tr>
<td></td>
<td></td>
<td>DEADBOLT</td>
</tr>
<tr>
<td>1</td>
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<td>E</td>
</tr>
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</table>

**DOOR TYPE:** E  
**CASING TRIM TYPE:** E  

**REMARKS:** INTERIOR NOT ACCESSIBLE 3'-4" x 7'-3 3/4" MASONRY OPENING  

**MARK:** 101D

**SOUTH FACE**

- REMOVE CLOSER BRACKET & PATCH HOLES
- REMOVE SIGNAGE & PATCH HOLES

**FACE**

- E

---

**DETAILS**

- MILAM COUNTY ANNEX, CAMERON, TX
- Architexas
### Detailed Door Inventory

**Location:** Milam County Annex, Cameron, TX

**South Face**: 
- **Door Type:** E
- **Trim Type:** E
- **Existing Door Hardware:**
  - **Type:**
    - Deadbolt: E
    - Hinges: E
    - Knob: E
    - Strike Plate: E
    - Rose: E
    - Mortise Lock: E
    - Push/Pull Plates: -
    - Threshold: E
- **Remarks:** Interior not accessible

**Face**: 
- **Door Type:** E
- **Trim Type:** E
- **Existing Door Hardware:**
  - **Type:**
    - Deadbolt: E
    - Hinges: E
    - Knob: E
    - Strike Plate: E
    - Rose: E
    - Mortise Lock: E
    - Push/Pull Plates: -
    - Threshold: E
- **Remarks:** Interior not accessible

**Mark:** 101E

---

**Architexas**
### Detailed Door Inventory

**Location:** Milam County Annex, Cameron, TX

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<thead>
<tr>
<th>FLOOR</th>
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<th>EXISTING DOOR HARDWARE:</th>
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<td>PUSH/PULL PLATES:</td>
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<td>THRESHOLD:</td>
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**Door Type:** E

**Casing Trim Type:**

**Remarks:**

**Mark:** 101F
# Detailed Door Inventory

**Location:** Milam County Annex, Cameron, TX

## Door Type: A

### Existing Door Hardware:

<table>
<thead>
<tr>
<th>Type</th>
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<th>Knob</th>
<th>Strike Plate</th>
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</table>

### Remarks:

- Replace door; restore frame

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**Note:** This inventory is part of a detailed analysis of door hardware and frame conditions for maintenance or replacement purposes.
<table>
<thead>
<tr>
<th>FLOOR</th>
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DOOR TYPE: F

CASING TRIM TYPE: 

REMARKS: 

MARK: 101L
**FLOOR ROOM #**

**MARK:**

**DOOR TYPE:**

**EXISTING DOOR HARDWARE:**

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**DOOR TYPE:**

**CASING TRIM TYPE:**

**REMARKS:**

**MARK:**  101L

---

**SOUTH FACE**
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**DOOR TYPE:** F

**CASING TRIM TYPE:**

**REMARKS:**

**MARK:** 101X

---

**DETAILED DOOR INVENTORY**

**MILAM COUNTY ANNEX, CAMERON, TX**
## Detailed Door Inventory

**West Face**

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**Door Type:** F

**Casing Trim Type:**

**Remarks:**

**Mark:** 101X
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<td>REMARKS:</td>
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REPAIR SCRATCHES

WEST FACE

EAST FACE

DETAILED DOOR INVENTORY
MILAM COUNTY ANNEX, CAMERON, TX
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<th>FLOOR</th>
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DOOR TYPE: G

CASING TRIM TYPE: 

REMARKS: 

MARK: 102C

REPLACE DOOR; RESTORE FRAME

NORTH FACE

SOUTH FACE

DETAILED DOOR INVENTORY
MILAM COUNTY ANNEX, CAMERON, TX

Architexas
### Detailed Door Inventory

**Location:** Milam County Annex, Cameron, TX

**Mark:** 102E

#### Existing Door Hardware:

<table>
<thead>
<tr>
<th>Floor</th>
<th>Room #</th>
<th>Type</th>
<th>Deadbolt</th>
<th>Hinges</th>
<th>Knob</th>
<th>Strike Plate</th>
<th>Rose</th>
<th>Mortise Lock</th>
<th>Push/Pull Plates</th>
<th>Threshold</th>
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<tbody>
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</table>

**Door Type:** G

**Casing Trim Type:**

**Remarks:** Replace door in existing frame

**Notes:**
- Repair frame holes from removed hardware
- Replace door; restore frame
### SOUTH FACE

**FLOOR**: 1  
**ROOM #**: 102F.1  
**MARK**

**REMARKS**:
- Replace broken glass

**EXISTING DOOR HARDWARE**:

<table>
<thead>
<tr>
<th>Type</th>
<th>EXISTING</th>
<th>DEADBOLT</th>
<th>HINGES</th>
<th>KNOB</th>
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</table>

**DOOR TYPE**: G  
**CASING TRIM TYPE**: 3'-7 3/4" x 7'-3 3/4" Masonry Opening  
**REMARKS**:
- Door @ 3'-4" x 6'-11"

### NORTH FACE

**FLOOR**: 1  
**ROOM #**: 102F.1  
**MARK**

**REMARKS**:
- Replace broken glass

**EXISTING DOOR HARDWARE**:

<table>
<thead>
<tr>
<th>Type</th>
<th>EXISTING</th>
<th>DEADBOLT</th>
<th>HINGES</th>
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</table>

**DOOR TYPE**: G  
**CASING TRIM TYPE**: 3'-7 3/4" x 7'-3 3/4" Masonry Opening  
**REMARKS**:
- Door @ 3'-4" x 6'-11"
**REMARKS:**

REPLACE DOOR; RESTORE FRAME

**EXISTING DOOR HARDWARE:**

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<thead>
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<th>TYPE</th>
<th>EAST FACE</th>
<th>WEST FACE</th>
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<tr>
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<tr>
<td>HINGES</td>
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<td>PUSH/PULL PLATES</td>
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<td>THRESHOLD</td>
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</table>

**DOOR TYPE:**

A

**CASING TRIM TYPE:**

**MARK:**

102H

**DETAILED DOOR INVENTORY**

MILAM COUNTY ANNEX, CAMERON, TX
### Detailed Door Inventory

**Location:** Milam County Annex, Cameron, TX

<table>
<thead>
<tr>
<th>Floor</th>
<th>Room #</th>
<th>Existing Door Hardware</th>
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</thead>
</table>
| 1     |        | **Type:** Deadbolt | East Face
|       |        | **Type:** Hinges   | East Face
|       |        | **Type:** Knob     | East Face
|       |        | **Type:** Strike Plate | East Face
|       |        | **Type:** Rose     | East Face
|       |        | **Type:** Mortise Lock | East Face
|       |        | **Type:** Push/Pull Plates | East Face
|       |        | **Type:** Threshold | East Face

- **Existing:**
  - **Type:** Deadbolt
  - **Type:** Hinges
  - **Type:** Knob
  - **Type:** Strike Plate
  - **Type:** Rose
  - **Type:** Mortise Lock
  - **Type:** Push/Pull Plates
  - **Type:** Threshold

**Door Type:** A

**Casing Trim Type:**

**Remarks:**

**Mark:** 102J

**Removal Instructions:**
- Remove Staining
### Detailed Door Inventory

**Location:** Milam County Annex, Cameron, TX

#### Existing Door Hardware:

<table>
<thead>
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<th>Floor</th>
<th>Room #</th>
<th>Type</th>
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<th>Hinges</th>
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**Door Type:** H

**Casing Trim Type:**

**Remarks:**

- Remove bars & repair frame
- Replace glass & metal glazing stops, set in full bed of sealant
- Replace door; restore frame

**Mark:** 107A.1
## Detailed Door Inventory

**Location:** Milam County Annex, Cameron, TX

### Existing Door Hardware:

<table>
<thead>
<tr>
<th>Type</th>
<th>East Face</th>
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### Door Type:

- **H**

### CASING TRIM TYPE:

- **H**

### Remarks:

- **ADJUST DOOR TO MAKE FULLY OPERABLE**
- **REPLACE GLAZING SEALANT 100%**

**Mark:** 107F.2

---

**Detailed Door Inventory**

MILAM COUNTY ANNEX, CAMERON, TX

**Architexas**
### Detailed Door Inventory

**MILAM COUNTY ANNEX, CAMERON, TX**

**Detailed Door Inventory**

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<tr>
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<td></td>
<td>TYPE:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DEADBOLT</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HINGES</td>
</tr>
<tr>
<td></td>
<td></td>
<td>KNOB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>STRIKE PLATE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ROSE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MORTISE LOCK</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PUSH/PULL PLATES</td>
</tr>
<tr>
<td></td>
<td></td>
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</tr>
<tr>
<td>1</td>
<td></td>
<td>EXISTING: E E E E E E E E E - -</td>
</tr>
</tbody>
</table>

**Door Type:** B  

**Casing Trim Type:**  

**Remarks:** INTERIOR NO ACCESSIBLE  

**Mark:** 107J.1

*Adjust door to make fully operable.*
### Detailed Door Inventory

**MILAM COUNTY ANNEX, CAMERON, TX**

**Remarks:**
- Replace glazing sealant 100%
- Adjust door to make fully operable

### Existing Door Hardware

<table>
<thead>
<tr>
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<th>Rose</th>
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<th>Push/Pull Plates</th>
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<td>E</td>
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<td>E</td>
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</table>

**Door Type:** H

**Casing Trim Type:**

**Remarks:** Interior not accessible

**Mark:** 107J.2
### Detailed Door Inventory

**MILAM COUNTY ANNEX, CAMERON, TX**

**SOUTH FACE**

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<thead>
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<td></td>
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<td>DEADBOLT: E</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>HINGES: E</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>KNOB: E</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>STRIKE PLATE: E</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ROSE: E</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MORTISE LOCK: E</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PUSH/PULL PLATES: -</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>THRESHOLD: -</td>
</tr>
</tbody>
</table>

**REMARKS:** ROOM NOT ACCESSIBLE

**MARK:** 107K.1
**SOUTH FACE**

**NORTH FACE**

<table>
<thead>
<tr>
<th>FLOOR</th>
<th>ROOM #</th>
<th>EXISTING DOOR HARDWARE:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>TYPE:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DEADBOLT: E E E E E E</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HINGES: E E E E E E</td>
</tr>
<tr>
<td></td>
<td></td>
<td>KNOB: E E E E E E</td>
</tr>
<tr>
<td></td>
<td></td>
<td>STRIKE PLATE: E E E E E</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ROSE: E E E E E E</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MORTISE LOCK: E E E E E</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PUSH/PULL PLATES: E E E</td>
</tr>
<tr>
<td></td>
<td></td>
<td>THRESHOLD: E E E E E</td>
</tr>
</tbody>
</table>

**DOOR TYPE:** A

**CASING TRIM TYPE:**

**REMARKS:** ROOM NOT ACCESSIBLE

**MARK:** 107K.2

**REMARKS:** REPLACE DOOR; RESTORE FRAME

**DETAILED DOOR INVENTORY**

MILAM COUNTY ANNEX, CAMERON, TX
FLOOR ROOM #

MARK:

DOOR TYPE:

REMARKS:

EXISTING DOOR HARDWARE:

TYPE:

DEADBOLT HINGES KNOB STRIKE PLATE ROSE MORTISE LOCK PUSH/PULL PLATES THRESHOLD

1 EXISTING: E E - E - E E E

DOOR TYPE: J

CASING TRIM TYPE:

REMARKS:

MARK: 107Y.3

SOUTH FACE NORTH FACE

REPLACE DOOR; RESTORE FRAME

DETAILED DOOR INVENTORY
MILAM COUNTY ANNEX, CAMERON, TX

Architexas
ASBESTOS ABATEMENT SPECIFICATIONS

Milam County
Hospital Annex, Convent and Mechanical Building
806 N. Crockett Ave.
Cameron, TX 76520

Project No. 20-1238

Prepared For:

Architexas
2900 South Congress, Suite 200
Austin, Texas 78704

March 22, 2020
ASBESTOS ABATEMENT SPECIFICATIONS

Milam County
Hospital Annex, Convent and Mechanical Building
806 N. Crockett Ave.
Cameron, TX 76520

Prepared By:

Wade Champion, IAC
Individual Asbestos Consultant
TDSHS Consultant's License No. 10-5410
Expiration Date 8/25/2021
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<td>15.0 Emergency Contingency Plans</td>
<td>17</td>
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<td>15.1 Containment Failure</td>
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<td>15.2 Spills</td>
<td>18</td>
</tr>
<tr>
<td>15.3 Medical Emergencies</td>
<td>18</td>
</tr>
<tr>
<td>15.4 Heat Stress</td>
<td>18</td>
</tr>
</tbody>
</table>

**APPENDICES**

APPENDIX A- LICENSES
APPENDIX B- NOTIFICATION(S)
APPENDIX C- REFERENCE DRAWING(S)
Asbestos Abatement Plan
Milam County
Hospital Annex, Convent and Mechanical Building
806 N. Crockett Ave.
Cameron, TX 76520

1.0 Introduction

The work covered by this work plan includes the handling, removal, disposal and/or demolition of identified materials in the approximately quantities.

### Hospital Annex

<table>
<thead>
<tr>
<th>Material</th>
<th>APPROXIMATE Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>12x12 Multicolor Floor Tile/ Mastic</td>
<td>35000 SF</td>
</tr>
<tr>
<td>Sink Undercoat</td>
<td>9 sinks</td>
</tr>
<tr>
<td>Duct Mastic</td>
<td>2000 LF*</td>
</tr>
<tr>
<td>CWS Insulation</td>
<td>2000 LF*</td>
</tr>
</tbody>
</table>

### Convent

<table>
<thead>
<tr>
<th>Material</th>
<th>APPROXIMATE Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceiling Texture</td>
<td>1283 SF</td>
</tr>
<tr>
<td>Wall Texture/Dry Wall</td>
<td>4464 SF</td>
</tr>
<tr>
<td>Joint Compound</td>
<td>Included in above quantity</td>
</tr>
<tr>
<td>Pink Ceramic Wall Tile/Grout</td>
<td>1230 SF</td>
</tr>
<tr>
<td>Sink Undercoat</td>
<td>1 sink</td>
</tr>
<tr>
<td>Roof Mastic</td>
<td>350 SF</td>
</tr>
</tbody>
</table>

### Mechanical Building

<table>
<thead>
<tr>
<th>Material</th>
<th>APPROXIMATE Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wall Texture/Dry Wall</td>
<td>2100 SF</td>
</tr>
<tr>
<td>Joint Compound</td>
<td>Included in above quantity</td>
</tr>
<tr>
<td>TSI Insulation</td>
<td>1000LF</td>
</tr>
<tr>
<td>Mastic, on concrete (exterior)</td>
<td>16 SF</td>
</tr>
</tbody>
</table>

It is the contractor's responsibility to verify quantities.

The intent of this work plan is to establish a set of operating standards to follow in order to insure full compliance with all the applicable federal, state, city and local rules, and regulations governing the abatement of ACM and to insure the protection of all workers, occupants, adjacent areas and the environment from the exposure to asbestos fibers.

The safety of employees, contracted personnel, and the general public during this work is of primary importance. Managers, Supervisors, and workers will be committed to, and will be directly responsible for maintaining their workplace in a safe and healthful condition. No person will be required or instructed to work in surroundings or under conditions which are unsafe or unhealthy.
Workers will be given the initial and periodic instruction on how to perform their assigned tasks in a safe and healthful manner. These workers will safely perform their duties as prescribed by their supervisors. If a situation arises in which an unsafe or unhealthful condition exists, it will be the duty of all personnel to notify others who may be immediately affected by the hazard and to notify the appropriate supervisor who has the power and authority to take corrective action to abate the hazard.

2.0 Scope of Work

The scope of work involves the handling, removal, disposal, and/or demolition activities involving the removal of ACM. This includes, but is not limited to the removal of ACM materials in the approximate quantities set forth below:

<table>
<thead>
<tr>
<th>Hospital Annex</th>
<th>APPROXIMATE Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Material</strong></td>
<td></td>
</tr>
<tr>
<td>12x12 Multicolor Floor Tile/ Mastic</td>
<td>35000 SF</td>
</tr>
<tr>
<td>Sink Undercoat</td>
<td>9 sinks</td>
</tr>
<tr>
<td>Duct Mastic</td>
<td>2000 LF*</td>
</tr>
<tr>
<td>CWS Insulation</td>
<td>2000 LF*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Convent</th>
<th>APPROXIMATE Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Material</strong></td>
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</tr>
<tr>
<td>Ceiling Texture</td>
<td>1283 SF</td>
</tr>
<tr>
<td>Wall Texture/Dry Wall</td>
<td>4464 SF</td>
</tr>
<tr>
<td>Joint Compound</td>
<td>Included in above quantity</td>
</tr>
<tr>
<td>Pink Ceramic Wall Tile/Grout</td>
<td>1230 SF</td>
</tr>
<tr>
<td>Sink Undercoat</td>
<td>1 sink</td>
</tr>
<tr>
<td>Roof Mastic</td>
<td>350 SF</td>
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<th>Mechanical Building</th>
<th>APPROXIMATE Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Material</strong></td>
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</tr>
<tr>
<td>Wall Texture/Dry Wall</td>
<td>2100 SF</td>
</tr>
<tr>
<td>Joint Compound</td>
<td>Included in above quantity</td>
</tr>
<tr>
<td>TSI Insulation</td>
<td>1000LF</td>
</tr>
<tr>
<td>Mastic, on concrete (exterior)</td>
<td>16 SF</td>
</tr>
</tbody>
</table>

*It is the contractor's responsibility to verify quantities.*
3.0 Applicable Standards and Publications

All contractor and subcontractors’ personnel will strictly adhere to the following applicable standards and/or publications:

- **ANSI Z9.2-1979** Fundamentals Governing the Design and Operation of Local Exhaust Systems
- **CFR 29 Part 1910** Occupational Safety and Health Standards
  - 1910.134 Respiratory Protection
  - 1910.1200 Hazard Communication
- **CFR 29 Part 1926** Occupational Safety and Health Regulations for Construction 1926.1101 Asbestos in Construction
- **Em 385-1-1 U.S. Army Corps of Engineers Safety and Health Requirements Manual, Revised 2 November 2003**
- **NFPA 701** Methods of Fire Test for Flame-Resistant Textiles and Films (1989)
- **NIOSH** Manual of Analytical Methods, ED., Vol.1 and 2
- **UL 586** Test Performance of High Efficiency Particulate Air Filter Units (1990)

4.0 Permits, Licenses, and Notifications

The contractor will comply with all applicable federal, state, city and local rules and regulations in regard to the application for and obtaining all permits, licenses and notifications required for asbestos remediation projects. Copies of all permits, licenses and notifications will be submitted and available for review upon request.

At least 10 days prior to commencement of any asbestos removal/demolition, the Contractor will prepare written notification to EPA Region 7 Office Asbestos Coordinator, PO 143238, Austin, TX 78714 in accordance with EPA, 40 CFR, Part 61, Subpart M, and to the State of Texas Department of Health, Clean Air Branch, PO 143538, Austin TX 78714, 800-572-5548. The Contractor will also obtain the required solid waste identification permits for disposal of asbestos contaminated waste from the State of Texas Department of Health, Clean Air Branch, PO 143538, Austin, TX 78714 800-572-5548.
5.0 Administration

5.1 Organization

5.1.1 Environmental Quality Control Manager (Champion)

The project will be managed by a Champion Environmental Consulting, Inc. (Champion) Project Manager who will have overall responsibility for the development, coordination and implementation of this Plan. The Champion Project Manager will be available at all times to coordinate with the clients or subcontractor’s Project Managers, Field Supervisors and Safety Representatives. Primarily, the Champion Project Manager will have the responsibility for hazardous materials management and waste disposal, and environmental regulatory compliance.

5.1.2 Site Safety Supervisor

The Champion Project Manager will appoint a Site Safety Supervisor (SSS) who will have the overall responsibility for the development, coordination and implementation of this Health and Safety Plan and its adherence by its subcontractors. This will include assurance that training requirements, monitoring procedures, adherence to all health and safety rules, etc. has been met. The SSS will coordinate with the Champion Project Manager on all modifications to the plan and will be available for consultation as necessary. The assignment of the SSS will vary dependent upon the scope of work at various sites. The SSS will implement this plan and will conduct the industrial hygiene and air monitoring requirements. The SSS has the authority to halt all work activities as necessary to ensure the safety of the site workers and the surrounding community.

5.1.3 Subcontractors

The abatement work will be conducted by a Licensed Abatement Contractor. All Subcontractors Field Supervisors are responsible for understanding, implementing and adhering to this Plan. The subcontractor is responsible and will assign a competent person for the project. The Field Supervisors will be responsible for their respective crews, for their adherence to the Plan, and for coordinating efforts with the Project Manager and the SSS.

5.2 Safety Briefings

Safety briefings for all affected employees will be conducted by the Champion Project Manager and SSS or Subcontractor each morning prior to work activities or as frequently as needed to assure the use of safe work practices and controls. The meeting will address the day’s work objectives, procedures, equipment, etc. to be used, and the particular hazards to be controlled for that day and to review past activities.
5.3 Inspections

Daily inspections of the work site, material and equipment will be conducted by the Champion Project Manager and the SSS to ensure compliance with this Plan, the U.S Army Corps requirements and OSHA regulations. These inspections will be incorporated into the Contractor’s quality control program. Identified safety and health issues and deficiencies, actions, timetables, and responsibilities for correcting the deficiencies will be recorded on the inspection reports. Follow-up inspections will be conducted and documented to ensure timely correction of any identified deficiencies.

5.4 Drug Abuse Policy

The use of drugs and/or alcohol in the workplace is strictly prohibited in accordance with state and federal laws and regulations and is in direct violation of the Contractor’s corporate policy. Personnel found to be under the influence of or consuming these substances while onsite will be immediately removed from the job site and appropriately disciplined in accordance with company policy.

5.5 Qualified Personnel

All persons working on the site will be physically, medically, and emotionally qualified for performing the duties to which they are assigned. Included are factors such as strength, endurance, agility, coordination, visual and hearing ability. Operators of any equipment will be able to read and understand the signs, signals, and operating instructions in use. Where exposure to hazardous chemicals and the use of respiratory equipment is required additional medical evaluations and clearances will be required, as described below. All workers, supervisors, and other personnel required to enter the Control Areas or engaged in asbestos abatement will be required to have medical surveillance, respirator testing meeting the requirements of OSHA’s 1926.1101

5.5.1 Competent Persons

Asbestos abatement will be supervised by the Contractor’s full-time, onsite Competent Person in asbestos abatement meeting the requirements of OSHA’s 1926.1101 and USEPA AHERA Contractor/Supervisors qualifications.

5.5.2 Workers

All Asbestos abatement workers will have current AHERA 32 Hour Worker certificates. All Asbestos abatement supervisors will have current AHERA 40 Hour Supervisor certificates. Additional site-specific training will include the following prior to the initiation of any abatement work:

1. Specific nature of the operation, which could result in exposure to asbestos.
2. Purpose, proper selection, fitting, use, and limitations of respirators.
3. Purpose and description of the medical surveillance program, including information concerning the adverse health effects associated with excessive exposure to asbestos
4. Relevant engineering controls and good work practices.
5. The contents of any compliance plan in effect.
6. The employee’s right of access to records under CFR 2.9 Part 1910.20

5.5.3 Designated Industrial Hygienist

Designated Industrial Hygienist (DIH) will be independently contracted by Champion and responsible to Champion with overall responsibility for the implementation, and enforcement of the Asbestos Abatement Plan, including the air-monitoring program. The DIH will not be present at the work site on a full-time basis but will delegate responsibilities to the Industrial Hygiene Technician (IHT). The DIH will be present at crucial points in the operations and will conduct regular onsite supervision and evaluation of effectiveness of the plan and the IHT(s) implementation. Supervision will include at least weekly inspections of the work site during asbestos removal and disposal operations.

Prior to all gross asbestos removal, the DIH will delegate to the IHT, the inspection of each asbestos control area to ensure the enclosure is properly and completely sealed, that safety precautions are followed, that the HEPA exhaust units provide sufficient ventilation (verified by pressure differential readings, volume calculations, and smoke testing), and to ensure the required respiratory and personal protective equipment is available for the project.

5.5.4 Industrial Hygiene Technician

Industrial Hygiene Technician (IHT) will be independent of the abatement contractor and directly accountable to the DIH. The IHT will be on site on a full-time basis for the duration of the project with functional responsibility for implementation and enforcement of the Asbestos Removal and Disposal Plans, including the air monitoring program and final visual inspections. The IHT will have a minimum of 1-year working experience in the asbestos abatement industry and will have a sound working knowledge of applicable State and Federal occupational safety and health regulations and formal training in occupational safety and health. The IHT will also have demonstration experience in asbestos air monitoring techniques, including successful completion of NIOSH 582 Sampling and Evaluating Airborne Asbestos Dust, and respiratory protection program implementation. The IHT has the authority to halt all work activities as necessary to ensure the safety of the site workers and the surrounding community is maintained.
5.6 Visitors

Generally, no visitors will be allowed into designated work areas during this work unless there is a compelling reason. However, if visitors such as county employees, state, federal or military representatives wish to visit the site, they will be briefed by the Champion Project Manager on the protocol and the visitor will be accompanied by the Champion Project Manager at all times. This briefing protocol will include the following:

1. reading the Plan.
2. providing a physician’s written opinion stating the visitor has no condition(s) which would prevent them from wearing the appropriate personal protective equipment. (PPE).
3. supplying a fit test record current to within 12 months and supplying his or her, own respirator is required.
4. signing the Daily Visitor Log.
5. wearing PPE as required at the site; and
6. following any other direction given by the Champion Project Manager and SSS.

6.0 Contractor Submittals (Pre-Start and Close-Out)

The following represents a listing of submittals, which will be provided, as obtained during the course of the project as required by the specifications:

1. air monitoring results.
2. bulk sampling reports.
3. final clearance statement.
4. waste disposal documentation; and
5. negative pressure enclosure recordings.
7.0 Asbestos Material Identification

The following approximate quantities outlined below, represent the materials scheduled for removal, disposal and/or demolition:

### Hospital Annex

<table>
<thead>
<tr>
<th>Material</th>
<th>APPROXIMATE Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>12x12 Multicolor Floor Tile/ Mastic</td>
<td>35000 SF</td>
</tr>
<tr>
<td>Sink Undercoat</td>
<td>9 sinks</td>
</tr>
<tr>
<td>Duct Mastic</td>
<td>2000 LF*</td>
</tr>
<tr>
<td>CWS Insulation</td>
<td>2000 LF*</td>
</tr>
</tbody>
</table>

### Convent

<table>
<thead>
<tr>
<th>Material</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Ceiling Texture</td>
<td>1283 SF</td>
</tr>
<tr>
<td>Wall Texture/Dry Wall</td>
<td>4464 SF</td>
</tr>
<tr>
<td>Joint Compound</td>
<td>Included in above quantity</td>
</tr>
<tr>
<td>Pink Ceramic Wall Tile/Grout</td>
<td>1230 SF</td>
</tr>
<tr>
<td>Sink Undercoat</td>
<td>1 sink</td>
</tr>
<tr>
<td>Roof Mastic</td>
<td>350 SF</td>
</tr>
</tbody>
</table>

### Mechanical Building

<table>
<thead>
<tr>
<th>Material</th>
<th>APPROXIMATE Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wall Texture/Dry Wall</td>
<td>2100 SF</td>
</tr>
<tr>
<td>Joint Compound</td>
<td>Included in above quantity</td>
</tr>
<tr>
<td>TSI Insulation</td>
<td>1000LF</td>
</tr>
<tr>
<td>Mastic, on concrete (exterior)</td>
<td>16 SF</td>
</tr>
</tbody>
</table>

It is the contractor's responsibility to verify quantities.

8.0 Sub-Contractors

A project sequencing and scheduling outline will be developed indicating the scope of work, date of use and duration of work for each Subcontractor. The following subcontractors have been selected and will be used during the course of this work:

<table>
<thead>
<tr>
<th>Service</th>
<th>Sub-Contractor</th>
<th>Point of Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asbestos Abatement Contractor</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>Transportation /Disposal</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>Air Monitoring, Inspection DIH and IHT</td>
<td>Champion Environmental</td>
<td>Wade Champion (512) 992 5383</td>
</tr>
</tbody>
</table>
9.0 Air, Bulk and Waste Sampling

An independent Designated Industrial Hygienist (DIH) will ensure that asbestos materials are sampled in accordance with applicable OSHA and EPA standards, good industrial hygiene practices, and as required for asbestos removal operations. Air and bulk sampling will be performed by an independent, qualified Industrial Hygiene Technician (IHT) approved by and under the direction of the DIH prior to work in each abatement area, during removal and at the completion of removal operations.

All air monitoring records will include the pump identification number, rotameter used, current calibration certificate, sample number, worker name and social security number, a detailed description of the nature and location of work, pump time on and time off, sample volume, description of engineering controls and personal protective equipment use, and chain of custody records. All records will be maintained and made available to the Owner at any time, upon request.

9.1 Asbestos Operations

9.1.1 Asbestos Pre-Abatement Air Sample

Pre-abatement, high volume sampling will be conducted at least one day prior to cleaning and removal of furnishings or other items from the asbestos control area and prior to masking and sealing operations. One sample will be taken per 10,000 square feet at a rate of not more than 15 liters per minute with a maximum sample volume of 2,400 liters.

9.1.2 Asbestos Abatement Air Samples

Daily, personal, TWA full-shift air sampling will be collected from a minimum of 25% of the work force for each exposure task during the duration of the work unless otherwise directed by the DIH. Sampling will be conducted on the worker expected to have the highest exposure. Excursion Limit (EL) sampling will also be conducted as required by OSHA. Flow rate will not exceed 2.5 liters per minute for evaluating Permissible Exposure Limits (PEL) and 3.5 liters per minute for the EL. Quality control samples will be submitted on a daily basis.

Barrier, Exhaust and Clean Room samples will be collected at a rate not to exceed 15 liters per minute with a maximum volume of 2,400 liters during each day of abatement activity as directed by the DIH. Barrier samples will be collected outside the building and downstream from the exhaust of the negative air machine. A Clean Room sample will be collected inside the Clean Room. Care will be taken to position cassettes such that high wind velocities or dead air spaces do not influence sampling.

9.1.3 Asbestos Clearance Samples
Aggressive clearance air samples will be collected after visual inspection and encapsulation of an Asbestos Control Area in accordance with EPA/AHERA requirements and as modified by the DIH as appropriate. One sample will be collected at a rate not to exceed 15 liters per minute with a minimum volume of 1,250 liters for each 10,000 square feet within each discrete Asbestos Control Area. The Abatement Contractor will maintain the integrity of the Asbestos Control Area and repeat cleanup, if necessary, until clearance levels average 0.01 f/cc or less or the references background concentrations have been achieved.

9.1.4 Asbestos Air Sample Analysis

PCM analysis will be performed on site by the IHT with NIOSH 582 training and successful participation in the American Industrial Hygiene Associations’ (AIHA) Proficiency Analytical Testing Program (PAT). Asbestos air monitoring results will be posted on-site within 24 hours of the sampling period.

10.0 Health and Safety

Safety is paramount. All Contractor employees and subcontracted employees will be knowledgeable and comply with all general safety practices (OSHA Standards). Compliance will be enhanced by utilizing daily “toolbox” safety meetings, partnering, and employee merit systems that will be overseen by a Site Safety Officer. Compromising health and safety will not be tolerated. The appropriate number and sized first aid kits will be maintained on-site for the duration of site work activities. A site-specific Emergency Action Plan (EAP) and Job Hazard Analysis (JHA) will be developed and will be available for submittal and review on-site.
11.0 Personal Protective Equipment

Personnel protective equipment (PPE) for personnel performing asbestos abatement activities will be selected and used to comply with OSHA’s Asbestos (29 CFR 1926.1101) standard.

11.1 Asbestos Operations

Personnel performing asbestos abatement operations will near NP ½ face respirators equipped with P100 or equivalent cartridges. Abatement workers will also wear full body, disposable suits with hoods and booties designed for asbestos abatement (i.e., spun bonded olefin or polypropylene). Impervious gloves and steel-toed rubber boots will also be worn. Gloves will be taped off as the work dictates.

12.0 Control Area Procedures

12.1 General Procedures

Asbestos Control Areas will be constructed and maintained to comply with OSHA’s Asbestos (29 CFR 1926.1101) standard, the key components are outlined below. A Critical Barrier will be constructed for all asbestos gross removal operations. The following additional requirements will apply:

1. All unnecessary and movable furnishings, equipment, and fixtures in the Control Areas will be pre-cleaned, if necessary, removed and stored in an area protected from contamination.
2. All entrances to Control Areas will be barricaded, and otherwise protected to prevent the inadvertent entry of unauthorized and unprotected personnel from entry.
3. All personnel entering those Control Areas will wear the appropriate PPE.
4. All hazardous debris will be bagged up and cleaned up promptly and at least at the end of each shift.
5. No eating, drinking, smoking, chewing, will be permitted within the Control Areas.
6. All work within the Control Areas will be supervised by the Competent Person.
7. Each Control Area will have an emergency exit.
8. The Critical Barrier will be visually inspected at the beginning of each work period. Compromised barriers will be immediately repaired upon discovery and re-inspected by the Competent Person and the IHT.
9. Signs will be provided, as appropriate, as displayed below:
12.1.1 Gross Removal of Asbestos

12.1.1.1 Polyethylene Sheeting

For asbestos gross removal of asbestos work, at least one layer of 6-mil poly will seal all doors and wall openings, grills, registers, diffusers, conduits, and other openings within the Control Area. Contractor shall provide flame-resistant polyethylene film that conforms to requirements set forth by the National Fire Protection Association Standard 701, Small Scale Fire Test for Flame-Resistant Textiles and Films. Polyethylene sheeting for walls and stationary objects shall be a minimum 4-mil thickness. For floors and all other uses, sheeting of at least 6-mil thickness shall be used in widths selected to minimize the frequency of joints and seams. Polyethylene sheeting utilized for worker decontamination enclosures shall be opaque if the decontamination enclosure is visible to building occupants.

Over the primary barrier, install as a drop cloth a clear 6-mil sheet plastic in all areas where asbestos removal work is to be carried out. Except in the case of floor tile and floor tile mastic removal, completely cover the floor with sheet plastic. Where the Work is within 10 feet of a wall, extend the secondary barrier up the wall to the ceiling. Support the sheet plastic on the wall with duct tape; seal the top of the secondary barrier to the primary barrier with duct tape so that debris cannot filter behind it. Provide cross-strips of duct tape at the wall support as necessary to support the sheet plastic and prevent its falling during removal operations.

Install the secondary barrier at the beginning of each work shift. Install only sufficient plastic for work of that shift. Remove the secondary barrier at the end of each work shift or as work in an area is completed. Fold the plastic toward the center of the sheet and pack into disposal bags. Keep the material on the sheet continually wet until bagged.

Regulated areas within which asbestos abatement is to be conducted shall be separated from adjacent areas by impermeable barriers of six- (6) mil polyethylene sheeting attached securely in place. All openings between containment areas and adjacent areas, including but not limited to windows, doorways, plenum areas above walls, elevator openings, corridor entrances, ventilation openings (both supply air and return air), drains, ducts, grills, grates, diffusers and skylights, shall be sealed with a minimum of a single layer of six- (6) mil polyethylene sheeting.

All penetrations that could permit air infiltration or air leaks through the barrier shall be sealed, with exceptions of the make-up air provisions and the means of entry and exit.
12.1.1.2 Negative Pressure Enclosure (NPE)

A Negative Pressure Enclosure (NPE) with at least -0.02" wc pressure and at least four (4) air changes per hour will be produced using HEPA-filtered negative air machines for all gross asbestos abatement operations. This NPE will be rigorously constructed and monitored with a continuously recording magnehelic gauge. All NPE’s will be maintained around the clock from the time abatement begins until clearance has been achieved. Negative pressure shall be maintained to prevent potential fiber migration into adjacent areas.

12.1.2 Asbestos Debris Cleanup

For asbestos debris cleanup, the Control Area will consist of barricades and signs at least 20" from the operations where feasible.

<table>
<thead>
<tr>
<th>Type of Removal</th>
<th>Critical Barrier</th>
<th>NPE</th>
<th>Continuous Magnehelic</th>
<th>Decon Facility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Removal</td>
<td>Yes- 1 Layer</td>
<td>Yes</td>
<td>Yes</td>
<td>3 Chamber</td>
</tr>
<tr>
<td>Debris Cleanup</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>HEPA Vac Remote</td>
</tr>
</tbody>
</table>

12.2 HVAC Systems

Any building ventilating system or any other system bringing air into or out of the Control Areas will be shut down and isolated by a lockable switch, disconnecting wires, removing circuit breakers, isolating by airtight seals, or other positive means that will prevent spread of contamination through the system and accidental premature restarting of the equipment. Where this is not feasible, branches feeding the Control Area will be disconnected, diverted, sealed and tested for leakage. Airtight seals will consist of rigid covers for supply and exhaust grills and two (2) layers of 6-mil poly. The HVAC systems(s) will remain inactivated until the DIH has cleared the Control Area served by the system. Isolation of the HVAC system(s) will be coordinated with the Clinic Administration and other effected trades on-site. HVAC equipment in or passing through the work areas should be shut down, wherever feasible. Where HVAC supply cannot be shut down, critical barriers shall include a rigid block (e.g., cardboard barrier) prior to polyethylene sheeting. All intake and exhaust openings and any seams in system components shall be sealed with at least six- (6) mil polyethylene sheeting and/or duct tape.
12.3 Electrical and Weather Systems

All electrical circuits within the Control Area will be identified, de-energized, tagged and locked out. All power used by the Contractor will be equipped with GFCI protection. All water systems within the Control Area will be shut down and isolated, where necessary.

12.4 HEPA Filtered Fans, Magnehelic Gauges, Vacuum Units

The appropriate number of HEPA filtered negative pressure machines will be located contiguous to the Control Areas in order to achieve a negative pressure differential of at least - 0.02" wc and 4 air changes per hour, as required. Negative air machines will be opened and inspected by the IHT in the presence of the Competent Person for any work seals and proper filter alignment prior to the start of work. Negative air machines will be exhausted directly outdoors and considerate of adjacent occupancies, etc. All negative pressure readings will be available for submittal and/or review upon request. Only HEPA filtered vacuums will be used on-site during asbestos operations. Debris collected by a HEPA vacuum will not be co-mingled.

12.5 Decontamination Facility

A three (3)-stage decontamination facility will be constructed of a minimum of two (2) layers of 6-mil poly, with at least three (3) layers on the floor. The rooms will be of a sufficient size to accommodate the operations and located to prevent workers from contaminating adjacent areas when leaving the Control Area. Each room will be separated by double “Z” flaps of 6-mil poly. The Shower will be equipped with soap and hot water. Towels will be provided in the Clean Room. Shower water will be filtered through a 5-um filter and discharged into the sanitary sewer system.

Prior to exiting the Control Area, workers will follow the decontamination procedures required by OSHA’s Asbestos (29 CFR 1926.1101) standard; the key components are outlined below:

1. Personnel entering the Control Area will remove street clothes and don appropriate PPE. All abatement workers will remove all street clothing and dress in only the protective clothing specified.
2. Personnel exiting the Control Area will remove gross contamination by HEPA vacuuming or wet cleaning from head to toe prior to entering the Equipment Room. Workers remove all clothing except respirators in the Equipment Room and place their disposable suits and gloves in a labeled 6-mil poly bag in the Equipment room. This room will be HEPA vacuumed or wet cleaned daily to avoid asbestos dust accumulations.
3. Still wearing the respirator, the worker will proceed to the Shower where the outside of the respirator and body are washed with soap and water. Just prior to exiting the Shower, the worker will either wet the respirator cartridges and dispose of them or seal them with tape or caps for future use. The floor of the
shower area will be covered with a minimum of three layers of 6-mil thick polyethylene sheeting unless it is constructed of an impervious, easily washable material. Shower water will be filtered for fibers greater than 5 micrometers in length to remove asbestos or collected and disposed as an asbestos contaminated waste.

4. The Clean Room will be used to store asbestos workers’ street clothing, clean protective clothing and equipment, and to provide a dressing area for personnel. Contaminated clothing will not be permitted in this room. Workers will only enter this room from the outside dressed in street clothes.

5. Contaminated work footwear may be stored in the Equipment Room when not in use in the Control Area. Upon completion of abatement, all footwear will be completely decontaminated with soap and water before being removed from the Control Area.

12.6 Material Decontamination

Require that the following procedure be used in removing equipment and bagged debris from the Work Room:

- three workers are required: one in the Work Room, one in the Change Room, and one on Step Off Area.
- equipment and bagged debris are to be removed in separate operations.
- collapse each bag of asbestos-containing waste materials with a HEPA vacuum twist top of bag, seal with at least 3 wraps of duct tape, bend over and seal again with at least 3 wraps of duct tape.
- the worker in Work Room shall clean equipment and bagged debris and hand one piece of equipment or one bag of debris at a time to worker in Change Room.
- the worker in Change Room shall wet clean each piece of equipment or bag and then store them in Change Room. Equipment is shall be sealed completely in 6 mil sheet plastic in the Change Room.
- when the amount of stored material in the Change Room becomes large enough that the worker cannot clean incoming material without contacting previously cleaned material the door between the Work Room and Clean Room is closed.
- the worker in the Changing Room then passes each item into a new disposal bag held open in the doorway between the Changing Room and Step Off Area by the worker on the Step Off Area. The Worker on the Step Off Area places each bag in a sealed cart for transport to the load out area. No bags are to be stored outside of the Control Area.
- all bags are to be transported through the building in clean sealed containers that have never been in an asbestos Work Area, Mini-Enclosure, or Decontamination Unit.
- double bagged ACM will be transported from the abatement area (enclosure) to a lined trailer or dumpster. Bagged ACM waste will be transported utilizing a utility cart lined and covered with 6-mil poly. The bagged ACM will be carted from the decontamination unit/load out area to the freight elevator and subsequently to the
north side loading docks on the ground level. Bagged ACM waste will then be transferred by hand to the lined trailer or dumpster.

12.7 Site Security

All doors leading into the work area(s) will be locked to prevent unauthorized entry. Corridors and entryways will be sealed with two (2) layers of 6-mil poly. The appropriate warning signs and/or barrier tape will be utilized and posted at these locations. All entrances to the Control Areas will be secured when removal operations are not in progress. Access by unauthorized individuals will be prohibited. Building security will be provided with access to 24-hour emergency telephone numbers.

13.0 Asbestos Removal

All asbestos removal activities will be performed in strict compliance with all applicable standards and publications identified within section 3.0 of this work plan.

14.0 Waste Packaging, Staging, Testing, Transportation and Disposal

14.1 Asbestos

The containerization and disposal of all friable and non-friable will be performed in accordance with all applicable federal, state, city and local regulations. All asbestos waste will be promptly sealed and double bagged in 6-mil poly bags or double wrapped in 6-mil poly sheathing. All debris will be maintained in a wetted condition at all times. These impervious containers will be labeled with the appropriate OSHA, EPA and DOT labels and placed in a secure, placarded area. Any transportation of packaged asbestos debris within or through occupied areas will be enclosed/covered containers following routes and times approved by the facility.

Waste bags and containers containing asbestos waste will be hauled away by the Contractor to disposal site approved by the facility as soon as there is a sufficient quantity for a truckload. Procedures for hauling and disposal will comply with EPA Standard 40 CFR, Part 61, and other applicable state, regional and local Government standard, the key components of the standards are outlined below. Only licensed asbestos transporters will be used.

1. Trucks hauling asbestos waste bags/containers will be totally enclosed to prevent loss or damage to bags/containers EnRoute to the disposal site.
2. Transporters will carry a wetting agent to be used in the event of an accidental spill. Transporters will be responsible for cleaning up any accidental spills, which occur during transfer, or unloading at the landfill.
3. All workers who participate in the transfer, loading or unloading of asbestos waste will be fully trained asbestos workers and all worker protection procedures specified herein will be applicable.
4. Prior to unloading asbestos waste at the landfill site, all workers will wear negative air pressure respirators, hooded disposable coveralls, disposable impervious gloves and washable boots.

5. At the conclusion of landfill site activities and prior to reentering the truck cab the employees will remove all personal protective equipment.

6. All disposable clothing and respirator cartridges will be removed, double bagged using 6-mil polyethylene, and disposed as asbestos waste prior to leaving the landfill site.

7. The respirator harness and washable boots will be separately wet-wiped and sealed in 6-mil polyethylene bags.

8. Only intact and sealed containers will be put into the approved landfill. Damaged bags or containers will be over packed in another 6-mil bag or sealed in additional impermeable containers and buried.

Upon completion of the asbestos removal work, the Contractor will submit a written statement attesting that all items containing asbestos have been disposed of in accordance with EPA 40, CFR, Part 61, and Subpart M in an approved sanitary landfill; the key components of the standards are outlined below. Documentation will include proof of regulatory approval and copies of completed Waste Shipment Records signed by the generator, transporter(s) and disposal site operator and listing the following information:

1. Name, address, and telephone number of the waste generator.

2. Name, address, of local, State, or EPA Regional agency responsible for administering the asbestos NESHAP program.

3. Quantity of asbestos-containing waste material in cubic meters or yards.

4. Name and telephone number of the disposal site operator.

5. Name and physical location of the disposal site.

6. Date transported.

7. Name, address and telephone number of the transporter(s).

8. A certification that the contents of the shipment are fully and accurately described by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to all applicable international and government regulations.

15.0 Emergency Contingency Plans

15.1 Containment Failure

The Abatement Contractor will ensure that sufficient backup systems are in place to ensure the delivery of continuous a negative pressure enclosure with at least -0.02” wc during all gross asbestos removal operations. This will include but will not be limited to the positioning of an emergency backup generator or other forms of independent power systems. If, due to unforeseen circumstances, negative pressure is lost during the course of this work, work will cease until further direction from the DIH has been received. All loose debris will be immediately wet with amended water and packaged.
The Contractor will ensure that all major breaches of containment barriers are repaired immediately. If a breach in a gross asbestos removal containment has occurred during an unattended period (i.e., at night), the DIH will be informed immediately. Work will not begin again until further notice direction from the DIH has been received.

15.2 Spills

Accidental spills of asbestos will be cleaned up immediately by qualified and properly protected personnel. All spills will be HEPA vacuumeed until all visible debris is removed. Spills on soils will include the removal of all suspect contaminated soils. All debris generated will be handled in accordance with the procedures in Section 14.0. Where friable asbestos has been spilled, the DIH will be notified immediately and the IHT will verify cleanup as directed by the DIH.

15.3 Medical Emergencies

All medical emergencies will be handled appropriately. Where the victim is contaminated, and the injury is less severe, decontamination will be performed prior to transporting the victim from the Control Area. Where the victim is severely injured with a life-threatening condition or where excessive, unrestrained movement may exacerbate the injury, cursory decontamination will be performed. In the scenario, the DIH will be informed immediately of the event.

15.4 Heat Stress

Personnel working in the sun, in hot and humid environments wearing protective clothing are at considerable risk of developing heat stress particularly when the temperature is 85 deg. F or higher. Adverse health effects of heat stress may range from transient heat fatigue to serious illness and even death. Heat stress may range from transient heat fatigue to serious illness and even death. Heat stress is caused by a number of factors including environmental conditions, the worker’s job requirements, and the individual’s susceptibility. Such susceptibility includes lack of physical fitness, lack of acclimatization, age, dehydration, obesity, alcohol and drug use, infection, sunburn, diarrhea, and some chronic diseases such as diabetes. Below is a list of signs and symptoms of heat stress:

- **Heat Cramps**: Painful muscle spasms that result from the loss of salt that occurs during sweating. Treatment includes rest and dehydration.

- **Heat Rash**: Can result from continuous exposure to hot, humid skin that has abraded against sweat-soaked clothes. Symptoms include localized red skin. Treatment includes washing, cooling and keeping dry.

- **Heat Exhaustion**: Result of reduced blood volume as a function of dehydration. Typical symptoms include fainting, headache, nausea, vertigo, weakness,
thirst, stumbling gait, poor coordination, poor judgment, irritability, and giddiness. Treatment includes removal of the worker from the work area to a cool, well-ventilated area, rest and dehydration. If untreated, heat stress can lead to heat stroke.

Heat Stroke  **Potentially fatal if not treated promptly!** and results when the victim’s internal temperature-regulating system shuts down. Symptoms include dry, warm, red or splotchy skin. Other symptoms include confusion, irrational behavior, loss of consciousness, convulsions, and lack of sweating. Emergency medical assistance will be summoned immediately. Victims should be cooled as rapidly as possible by immersion in cold water and packing in ice.

The Contractor will assure that this heat stress monitoring program will be implemented to avoid heat related injuries and illnesses. Prevention includes proper evaluation of the heat stress factors, providing safe work rest regimens, providing a sufficient period of acclimation, and requiring all personnel to continually hydrate. Any worker who has a pulse in excess of 100 bpm after a rest break should not resume work until his pulse rate has been decreased to below 100 bpm. Adequate rest and break periods should be provided. Rest areas will be provided in a shaded area. Ample, cool water will be provided, and all workers will be regularly instructed to drink at the rate of 7 ounces every 15 minutes since acclimatized persons can lose up to 2 gallons of water per work shift. The Competent Person and the Champion Project Manager will carefully and frequently observe the workers for signs and symptoms of heat stress.
APPENDIX B
NOTIFICATION

To be submitted by successful abatement contractor
**NOTES:**

- Multicolor Floor Tile/Mastic (~35,000 SF)
- Sink Undercoat (9 Sinks)

*Full extents of these materials cannot be determined as they are above ceiling*
NOTE:
Pink Ceramic Wall Tile/Grout in All Restrooms (1,230 SF)
Old Cooling Tower

- TSI on Pipes (1,000 LF)
- Black Mastic
- Drywall/Wall Texture/Joint Compound (2,100 SF)

Archer Texas
2900 South Congress, Suite 200
Austin, Texas 78704

CLIENT:

MILAM COUNTY
Mechanical Building

LOCATION:

Milam County

PLAN:

ARCHITEXAS

Wade Champion
Individual Asbestos Consultant
TDSH License No
10-5410
Renews 8/25/2021
Mechanical Compliance Certificate

Project Information
Energy Code: 2015 IECC
Project Title: Milam County Annex
Location: Cameron, Texas
Climate Zone: 2a
Project Type: New Construction

Construction Site: 806 N. Crockett Ave.
Cameron, TX 76520
Owner/Agent: APTUS Engineering
1919 S 1st St Bldg B
Austin, TX 78704
Designer/Contractor: APTUS Engineering
1919 S 1st St Bldg B
Austin, TX 78704

Additional Efficiency Package(s)
Reduced interior lighting power. Requirements are implicitly enforced within interior lighting allowance calculations.

Mechanical Systems List

<table>
<thead>
<tr>
<th>Quantity</th>
<th>System Type &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>SS-1 - SS-5 (Single Zone): Cooling: 1 each - Split System, Capacity = 23 kBtu/h, Air-Cooled Condenser, Unknown Economizer Proposed Efficiency = 21.40 SEER, Required Efficiency: 13.00 SEER Fan System: SS-1 -- Compliance (Motor nameplate HP method) : Passes Fans: SS1 Supply, Constant Volume, 775 CFM, 0.5 motor nameplate hp, 0.0 fan efficiency grade</td>
</tr>
<tr>
<td>1</td>
<td>AHU-1 (Single Zone): Cooling: 1 each - Hydronic Coil, Capacity = 323 kBtu/h, Air Economizer No minimum efficiency requirement applies Fan System: AHU-1 -- Compliance (Motor nameplate HP method) : Passes Fans: AHU1 Supply, Multi-Zone VAV, 10000 CFM, 10.0 motor nameplate hp, 0.0 fan efficiency grade</td>
</tr>
<tr>
<td>1</td>
<td>AHU-2 (Single Zone): Cooling: 1 each - Hydronic Coil, Capacity = 774 kBtu/h, Air Economizer No minimum efficiency requirement applies Fan System: AHU-2 -- Compliance (Motor nameplate HP method) : Passes Fans: AHU2 Supply, Multi-Zone VAV, 25000 CFM, 22.0 motor nameplate hp, 0.0 fan efficiency grade</td>
</tr>
<tr>
<td>1</td>
<td>AHU-3 (Single Zone): Heating: 1 each - Hydronic or Steam Coil, Hot Water, Capacity = 291 kBtu/h No minimum efficiency requirement applies Cooling: 1 each - Hydronic Coil, Capacity = 325 kBtu/h, Air Economizer No minimum efficiency requirement applies Fan System: AHU-3 -- Compliance (Motor nameplate HP method) : Passes Fans: AHU3 Supply, Single-Zone VAV, 4000 CFM, 4.0 motor nameplate hp, 0.0 fan efficiency grade</td>
</tr>
</tbody>
</table>
Mechanical Compliance Statement

Compliance Statement: The proposed mechanical design represented in this document is consistent with the building plans, specifications, and other calculations submitted with this permit application. The proposed mechanical systems have been designed to meet the 2015 IECC requirements in COMcheck Version 4.1.1.0 and to comply with any applicable mandatory requirements listed in the Inspection Checklist.

Sujay Regmi, P.E.  
Name - Title  
Signature  
05/19/2020  
Date

Project Title: Milam County Annex  
Data filename: A:\PROJECTS\19-076 Milam County Office Bldg\Design\ComCheck\Milam County Annex - Mechanical Comcheck.cck  
Report date: 05/14/20  
Page 2 of 13
Inspection Checklist

Energy Code: 2015 IECC

Requirements: 0.0% were addressed directly in the COMcheck software

Text in the "Comments/Assumptions" column is provided by the user in the COMcheck Requirements screen. For each requirement, the user certifies that a code requirement will be met and how that is documented, or that an exception is being claimed. Where compliance is itemized in a separate table, a reference to that table is provided.

<table>
<thead>
<tr>
<th>Section # &amp; Req.ID</th>
<th>Plan Review</th>
<th>Complies?</th>
<th>Comments/Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>C103.2 [PR2]</td>
<td>Plans, specifications, and/or calculations provide all information with which compliance can be determined for the mechanical systems and equipment and document where exceptions to the standard are claimed. Load calculations per acceptable engineering standards and handbooks.</td>
<td>☐ Complies</td>
<td></td>
</tr>
</tbody>
</table>

Additional Comments/Assumptions:
### Section # & Req.ID

<table>
<thead>
<tr>
<th>Section # &amp; Req.ID</th>
<th>Footing / Foundation Inspection</th>
<th>Complies?</th>
<th>Comments/Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>C403.2.4.5,</td>
<td>Snow/ice melting system sensors for future connection to controls. Freeze protection systems</td>
<td>☐ Complies</td>
<td></td>
</tr>
<tr>
<td>C403.2.4.6 [F09]^3</td>
<td>have automatic controls installed.</td>
<td>☐ Does Not</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>☐ Not Observable</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>☐ Not Applicable</td>
<td></td>
</tr>
</tbody>
</table>

**Additional Comments/Assumptions:**

1 High Impact (Tier 1)  2 Medium Impact (Tier 2)  3 Low Impact (Tier 3)
<table>
<thead>
<tr>
<th>Section # &amp; Req.ID</th>
<th>Plumbing Rough-In Inspection</th>
<th>Complies?</th>
<th>Comments/Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>C404.5, C404.5.1, C404.5.2 [PL6]^3</td>
<td>Heated water supply piping conforms to pipe length and volume requirements. Refer to section details.</td>
<td>![Option] Complies</td>
<td></td>
</tr>
<tr>
<td>C404.5, C404.5.1, C404.5.2 [PL6]^3</td>
<td>Heated water supply piping conforms to pipe length and volume requirements. Refer to section details.</td>
<td>![Option] Complies</td>
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<td>C404.5, C404.5.1, C404.5.2 [PL6]^3</td>
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<td>C404.7 [PL8]^3</td>
<td>Water distribution system that pumps water from a heated-water supply pipe back to the heated-water source through a cold-water supply pipe is a demand recirculation water system. Pumps within this system have controls that start the pump upon receiving a signal from the action of a user of a fixture or appliance and limits the temperature of the water entering the cold-water piping to 104°F.</td>
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Additional Comments/Assumptions:

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<tr>
<td>C402.2.6 [ME41]</td>
<td>Thermally ineffective panel surfaces of sensible heating panels have insulation &gt;= R-3.5.</td>
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<td>C403.2.12 .1 [ME65]</td>
<td>HVAC fan systems at design conditions do not exceed allowable fan system motor nameplate hp or fan system bhp.</td>
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<td>C403.2.12 .3 [ME117]</td>
<td>Fans have efficiency grade (FEG) &gt;= 67. The total efficiency of the fan at the design point of operation &lt;= 15% of maximum total efficiency of the fan.</td>
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<td>C403.2.13 [ME71]</td>
<td>Unenclosed spaces that are heated use only radiant heat.</td>
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<td>C403.2.3 [ME55]</td>
<td>HVAC equipment efficiency verified.</td>
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<td>C403.2.4.7 [ME113]</td>
<td>Fault detection and diagnostics installed with air-cooled unitary DX units having economizers.</td>
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<tr>
<td>C403.2.6.1 [ME59]</td>
<td>Demand control ventilation provided for spaces &gt;500 ft² and &gt;25 people/1000 ft² occupant density and served by systems with air side economizer, auto modulating outside air damper control, or design airflow &gt;3,000 cfm.</td>
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<tr>
<td>C403.2.6.2 [ME115]</td>
<td>Enclosed parking garage ventilation has automatic contaminant detection and capacity to stage or modulate fans to 50% or less of design capacity.</td>
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<td>C403.2.7 [ME57]</td>
<td>Exhaust air energy recovery on systems meeting Table C403.2.7(1) and C403.2.7(2).</td>
<td>Complies</td>
<td></td>
</tr>
<tr>
<td>C403.2.8 [ME116]</td>
<td>Kitchen exhaust systems comply with replacement air and conditioned supply air limitations, and satisfy hood rating requirements and maximum exhaust rate criteria.</td>
<td>Complies</td>
<td></td>
</tr>
<tr>
<td>C403.2.9 [ME60]</td>
<td>HVAC ducts and plenums insulated. Where ducts or plenums are installed in or under a slab, verification may need to occur during Foundation Inspection.</td>
<td>Complies</td>
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<td>C403.2.9 [ME10]</td>
<td>Ducts and plenums sealed based on static pressure and location.</td>
<td>Complies</td>
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<tr>
<td>C403.2.9.1.3 [ME11]</td>
<td>Ductwork operating &gt;3 in. water column requires air leakage testing.</td>
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<td>Air economizers provided where required, meet the requirements for design capacity, control signal, ventilation controls, high-limit shut-off, integrated economizer control, and provide a means to relieve excess outside air during operation.</td>
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<td>C403.4.2.6 [ME26]³</td>
<td>Chilled water plants with multiple chillers have capability to reduce flow automatically through the chiller plant when a chiller is shut down. Boiler plants with multiple boilers have the capability to reduce flow automatically through the boiler plant when a boiler is shut down.</td>
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<td>Multiple zone VAV systems with DDC of individual zone boxes have static pressure setpoint reset controls.</td>
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<td>C403.4.5 [ME31]³</td>
<td>Condenser heat recovery system that can heat water to 85 °F or provide 60% of peak heat rejection is installed for preheating of service hot water.</td>
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<td>C408.2.2.1</td>
<td>Air outlets and zone terminal devices have means for air balancing.</td>
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<td>C403.5, C403.5.1,</td>
<td>Refrigerated display cases, walk-in coolers or walk-in freezers served by remote compressors and remote condensers not located in a condensing unit, have fan-powered condensers that comply with Sections C403.5.1 and refrigeration compressor systems that comply with C403.5.2.</td>
<td>☑ Complies</td>
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<td>ME123</td>
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<td>C303.3, C408.2.5.3 [FI8]^3</td>
<td>Furnished O&amp;M manuals for HVAC systems within 90 days of system acceptance.</td>
<td>☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable</td>
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<td>C403.2.2 [FI27]^3</td>
<td>HVAC systems and equipment capacity does not exceed calculated loads.</td>
<td>☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable</td>
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<td>C403.2.4.1 [FI47]^3</td>
<td>Heating and cooling to each zone is controlled by a thermostat control. Minimum one humidity control device per installed humidification/dehumidification system.</td>
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<td>C403.2.4.1.2 [FI38]^3</td>
<td>Thermostatic controls have a 5 °F deadband.</td>
<td>☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable</td>
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<tr>
<td>C403.2.4.1.3 [FI20]^3</td>
<td>Temperature controls have setpoint overlap restrictions.</td>
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<td>C403.2.4.2 [FI39]^3</td>
<td>Each zone equipped with setback controls using automatic time clock or programmable control system.</td>
<td>☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable</td>
<td></td>
</tr>
<tr>
<td>C403.2.4.2.1, C403.2.4.2.2 [FI40]^3</td>
<td>Automatic Controls: Setback to 55°F (heat) and 85°F (cool); 7-day clock, 2-hour occupant override, 10-hour backup</td>
<td>☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable</td>
<td></td>
</tr>
<tr>
<td>C403.2.4.2.3 [FI41]^3</td>
<td>Systems include optimum start controls.</td>
<td>☐ Complies ☐ Does Not ☐ Not Observable ☐ Not Applicable</td>
<td></td>
</tr>
</tbody>
</table>

1 High Impact (Tier 1)  2 Medium Impact (Tier 2)  3 Low Impact (Tier 3)
<table>
<thead>
<tr>
<th>Section # &amp; Req.ID</th>
<th>Final Inspection</th>
<th>Complies?</th>
<th>Comments/Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>C403.2.4.2.3</td>
<td>Systems include optimum start controls.</td>
<td>☐ Complies&lt;br&gt;☐ Does Not&lt;br&gt;☐ Not Observable&lt;br&gt;☐ Not Applicable</td>
<td></td>
</tr>
<tr>
<td>C403.2.4.2.3</td>
<td>Systems include optimum start controls.</td>
<td>☐ Complies&lt;br&gt;☐ Does Not&lt;br&gt;☐ Not Observable&lt;br&gt;☐ Not Applicable</td>
<td></td>
</tr>
<tr>
<td>C403.2.4.2.3</td>
<td>Systems include optimum start controls.</td>
<td>☐ Complies&lt;br&gt;☐ Does Not&lt;br&gt;☐ Not Observable&lt;br&gt;☐ Not Applicable</td>
<td></td>
</tr>
<tr>
<td>C408.2.1.1</td>
<td>Commissioning plan developed by registered design professional or approved agency.</td>
<td>☐ Complies&lt;br&gt;☐ Does Not&lt;br&gt;☐ Not Observable&lt;br&gt;☐ Not Applicable</td>
<td></td>
</tr>
<tr>
<td>C408.2.3.1</td>
<td>HVAC equipment has been tested to ensure proper operation.</td>
<td>☐ Complies&lt;br&gt;☐ Does Not&lt;br&gt;☐ Not Observable&lt;br&gt;☐ Not Applicable</td>
<td></td>
</tr>
<tr>
<td>C408.2.3.2</td>
<td>HVAC control systems have been tested to ensure proper operation, calibration and adjustment of controls.</td>
<td>☐ Complies&lt;br&gt;☐ Does Not&lt;br&gt;☐ Not Observable&lt;br&gt;☐ Not Applicable</td>
<td></td>
</tr>
<tr>
<td>C408.2.3.3</td>
<td>Economizers have been tested to ensure proper operation.</td>
<td>☐ Complies&lt;br&gt;☐ Does Not&lt;br&gt;☐ Not Observable&lt;br&gt;☐ Not Applicable</td>
<td></td>
</tr>
<tr>
<td>C408.2.4.1</td>
<td>Preliminary commissioning report completed and certified by registered design professional or approved agency.</td>
<td>☐ Complies&lt;br&gt;☐ Does Not&lt;br&gt;☐ Not Observable&lt;br&gt;☐ Not Applicable</td>
<td></td>
</tr>
<tr>
<td>C408.2.5.1</td>
<td>Furnished HVAC as-built drawings submitted within 90 days of system acceptance.</td>
<td>☐ Complies&lt;br&gt;☐ Does Not&lt;br&gt;☐ Not Observable&lt;br&gt;☐ Not Applicable</td>
<td></td>
</tr>
<tr>
<td>C408.2.5.3</td>
<td>An air and/or hydronic system balancing report is provided for HVAC systems.</td>
<td>☐ Complies&lt;br&gt;☐ Does Not&lt;br&gt;☐ Not Observable&lt;br&gt;☐ Not Applicable</td>
<td></td>
</tr>
<tr>
<td>C408.2.5.4</td>
<td>Final commissioning report due to building owner within 90 days of receipt of certificate of occupancy.</td>
<td>☐ Complies&lt;br&gt;☐ Does Not&lt;br&gt;☐ Not Observable&lt;br&gt;☐ Not Applicable</td>
<td></td>
</tr>
</tbody>
</table>

**Additional Comments/Assumptions:**

1 | High Impact (Tier 1) | 2 | Medium Impact (Tier 2) | 3 | Low Impact (Tier 3)
Interior Lighting Compliance Certificate

Project Information

Energy Code: 2015 IECC
Project Title: Milam County Offices
Project Type: Alteration

Construction Site: 806 N Crockett Ave 76520
Owner/Agent: APTUS Engineering
1919 S 1st St
Bldg B
Austin, TX 78704

Allowed Interior Lighting Power

<table>
<thead>
<tr>
<th>Area Category</th>
<th>B Floor Area (ft²)</th>
<th>C Allowed Watts / ft²</th>
<th>D Allowed Watts (B X C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Office</td>
<td>33633</td>
<td>0.82</td>
<td>27579</td>
</tr>
<tr>
<td>Total Allowed Watts =</td>
<td></td>
<td></td>
<td>27579</td>
</tr>
</tbody>
</table>

Proposed Interior Lighting Power

<table>
<thead>
<tr>
<th>Fixture ID</th>
<th>Description / Lamp / Wattage Per Lamp / Ballast</th>
<th>B Lamps/Fixture</th>
<th>C # of Fixtures</th>
<th>D Fixture Watt.</th>
<th>E (C X D)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office (33633 sq.ft.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LED 1: A1: Other:</td>
<td>1</td>
<td>306</td>
<td>32</td>
<td>9792</td>
<td></td>
</tr>
<tr>
<td>LED 2: A2: Other:</td>
<td>1</td>
<td>67</td>
<td>43</td>
<td>2881</td>
<td></td>
</tr>
<tr>
<td>LED 3: B: Other:</td>
<td>1</td>
<td>67</td>
<td>30</td>
<td>2010</td>
<td></td>
</tr>
<tr>
<td>LED 4: C1: Other:</td>
<td>1</td>
<td>38</td>
<td>11</td>
<td>418</td>
<td></td>
</tr>
<tr>
<td>LED 5: C2: Other:</td>
<td>1</td>
<td>4</td>
<td>22</td>
<td>88</td>
<td></td>
</tr>
<tr>
<td>LED 6: D: Other:</td>
<td>1</td>
<td>11</td>
<td>11</td>
<td>121</td>
<td></td>
</tr>
<tr>
<td>LED 7: E: Other:</td>
<td>1</td>
<td>25</td>
<td>40</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>LED 8: G: Other:</td>
<td>1</td>
<td>27</td>
<td>34</td>
<td>918</td>
<td></td>
</tr>
<tr>
<td>LED 9: J: Other:</td>
<td>1</td>
<td>13</td>
<td>29</td>
<td>377</td>
<td></td>
</tr>
<tr>
<td>Total Proposed Watts =</td>
<td>17605</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Interior Lighting PASSES

Interior Lighting Compliance Statement

Compliance Statement: The proposed interior lighting alteration project represented in this document is consistent with the building plans, specifications, and other calculations submitted with this permit application. The proposed interior lighting systems have been designed to meet the 2015 IECC requirements in COMcheck Version 4.1.2.1 and to comply with any applicable mandatory requirements listed in the Inspection Checklist.

Sujay Regmi, P.E.
Name - Title
Signature
05/19/2020
Date
### Project Information

- **Energy Code:** 2015 IECC
- **Project Title:** Milam County Offices
- **Project Type:** Alteration
- **Exterior Lighting Zone:** 2 (Residential mixed use area)

- **Construction Site:** 806 N Crockett Ave 76520
- **Owner/Agent:**
- **Designer/Contractor:** APTUS Engineering 1919 S 1st St Bldg B Austin, TX 78704

### Allowed Exterior Lighting Power

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Area/Surface Category</strong></td>
<td><strong>Quantity</strong></td>
<td><strong>Allowed Watts / Unit</strong></td>
<td><strong>Tradable Wattage</strong></td>
<td><strong>Allowed Watts (B X C)</strong></td>
</tr>
<tr>
<td>Entry canopy</td>
<td>826 ft²</td>
<td>0.25</td>
<td>Yes</td>
<td>206</td>
</tr>
<tr>
<td>Walkway &lt; 10 feet wide</td>
<td>959 ft of</td>
<td>0.7</td>
<td>Yes</td>
<td>671</td>
</tr>
<tr>
<td>Other door (not main entry)</td>
<td>39 ft of door</td>
<td>20</td>
<td>Yes</td>
<td>780</td>
</tr>
</tbody>
</table>

Total Tradable Watts (a) = 1658

Total Allowed Watts = 1658

Total Allowed Supplemental Watts (b) = 600

(a) Wattage tradeoffs are only allowed between tradable areas/surfaces.

(b) A supplemental allowance equal to 600 watts may be applied toward compliance of both non-tradable and tradable areas/surfaces.

### Proposed Exterior Lighting Power

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast</strong></td>
<td><strong>Lamps/Fixture</strong></td>
<td><strong># of Fixtures</strong></td>
<td><strong>Fixure Watt.</strong></td>
<td><strong>(C X D)</strong></td>
</tr>
<tr>
<td>Entry canopy (826 ft²): Tradable Wattage</td>
<td>1</td>
<td>5</td>
<td>29</td>
<td>145</td>
</tr>
<tr>
<td>Walkway &lt; 10 feet wide (959 ft of walkway length): Tradable Wattage</td>
<td>1</td>
<td>12</td>
<td>25</td>
<td>300</td>
</tr>
<tr>
<td>Other door (not main entry) (39 ft of door width): Tradable Wattage</td>
<td>1</td>
<td>5</td>
<td>29</td>
<td>145</td>
</tr>
<tr>
<td>LED 4: K: Other:</td>
<td>1</td>
<td>2</td>
<td>23</td>
<td>46</td>
</tr>
</tbody>
</table>

Total Tradable Proposed Watts = 636

### Exterior Lighting PASSES

**Exterior Lighting Compliance Statement**

*Compliance Statement:* The proposed exterior lighting alteration project represented in this document is consistent with the building plans, specifications, and other calculations submitted with this permit application. The proposed exterior lighting systems have been designed to meet the 2015 IECC requirements in COMcheck Version 4.1.2.1 and to comply with any applicable mandatory requirements listed in the Inspection Checklist.
Inspection Checklist

Requirements: 0.0% were addressed directly in the COMcheck software

Text in the "Comments/Assumptions" column is provided by the user in the COMcheck Requirements screen. For each requirement, the user certifies that a code requirement will be met and how that is documented, or that an exception is being claimed. Where compliance is itemized in a separate table, a reference to that table is provided.

<table>
<thead>
<tr>
<th>Section # &amp; Req.ID</th>
<th>Plan Review</th>
<th>Complies?</th>
<th>Comments/Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>C103.2 [PR4](^1)</td>
<td>Plans, specifications, and/or calculations provide all information with which compliance can be determined for the interior lighting and electrical systems and equipment and document where exceptions to the standard are claimed. Information provided should include interior lighting power calculations, wattage of bulbs and ballasts, transformers and control devices.</td>
<td>☐ Complies</td>
<td>☐ Does Not</td>
</tr>
<tr>
<td></td>
<td></td>
<td>☐ Not Observable</td>
<td>☐ Not Applicable</td>
</tr>
<tr>
<td>C103.2 [PR8](^1)</td>
<td>Plans, specifications, and/or calculations provide all information with which compliance can be determined for the exterior lighting and electrical systems and equipment and document where exceptions to the standard are claimed. Information provided should include exterior lighting power calculations, wattage of bulbs and ballasts, transformers and control devices.</td>
<td>☐ Complies</td>
<td>☐ Does Not</td>
</tr>
<tr>
<td></td>
<td></td>
<td>☐ Not Observable</td>
<td>☐ Not Applicable</td>
</tr>
<tr>
<td>C406 [PR9](^1)</td>
<td>Plans, specifications, and/or calculations provide all information with which compliance can be determined for the additional energy efficiency package options.</td>
<td>☐ Complies</td>
<td>☐ Does Not</td>
</tr>
<tr>
<td></td>
<td></td>
<td>☐ Not Observable</td>
<td>☐ Not Applicable</td>
</tr>
</tbody>
</table>

Additional Comments/Assumptions:

1 High Impact (Tier 1)  2 Medium Impact (Tier 2)  3 Low Impact (Tier 3)
<table>
<thead>
<tr>
<th>Section # &amp; Req.ID</th>
<th>Rough-In Electrical Inspection</th>
<th>Complies?</th>
<th>Comments/Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>C405.2.1 [EL15]</td>
<td>Lighting controls installed to uniformly reduce the lighting load by at least 50%.</td>
<td>☐ Complies</td>
<td>☐ Does Not</td>
</tr>
<tr>
<td>C405.2.1 [EL18]</td>
<td>Occupancy sensors installed in required spaces.</td>
<td>☐ Complies</td>
<td>☐ Does Not</td>
</tr>
<tr>
<td>C405.2.1, C405.2.2, 3 [EL23]</td>
<td>Independent lighting controls installed per approved lighting plans and all manual controls readily accessible and visible to occupants.</td>
<td>☐ Complies</td>
<td>☐ Does Not</td>
</tr>
<tr>
<td>C405.2.2.1 [EL22]</td>
<td>Automatic controls to shut off all building lighting installed in all buildings.</td>
<td>☐ Complies</td>
<td>☐ Does Not</td>
</tr>
<tr>
<td>C405.2.3 [EL16]</td>
<td>Daylight zones provided with individual controls that control the lights independent of general area lighting.</td>
<td>☐ Complies</td>
<td>☐ Does Not</td>
</tr>
<tr>
<td>C405.2.3, C405.2.3.1, C405.2.3.2 [EL20]</td>
<td>Primary sidelighted areas are equipped with required lighting controls.</td>
<td>☐ Complies</td>
<td>☐ Does Not</td>
</tr>
<tr>
<td>C405.2.3, C405.2.3.1, C405.2.3.2, 3 [EL21]</td>
<td>Enclosed spaces with daylight area under skylights and rooftop monitors are equipped with required lighting controls.</td>
<td>☐ Complies</td>
<td>☐ Does Not</td>
</tr>
<tr>
<td>C405.2.4 [EL4]</td>
<td>Separate lighting control devices for specific uses installed per approved lighting plans.</td>
<td>☐ Complies</td>
<td>☐ Does Not</td>
</tr>
<tr>
<td>C405.2.4 [EL8]</td>
<td>Additional interior lighting power allowed for special functions per the approved lighting plans and is automatically controlled and separated from general lighting.</td>
<td>☐ Complies</td>
<td>☐ Does Not</td>
</tr>
<tr>
<td>C405.2.5 [EL25]null</td>
<td>Automatic lighting controls for exterior lighting installed. Controls will be daylight controlled, set based on business operation time-of-day, or reduce connected lighting &gt; 30%.</td>
<td>☐ Complies</td>
<td>☐ Does Not</td>
</tr>
<tr>
<td>C405.3 [EL6]</td>
<td>Exit signs do not exceed 5 watts per face.</td>
<td>☐ Complies</td>
<td>☐ Does Not</td>
</tr>
</tbody>
</table>

Additional Comments/Assumptions:

1 High Impact (Tier 1)  2 Medium Impact (Tier 2)  3 Low Impact (Tier 3)
<table>
<thead>
<tr>
<th>Section # &amp; Req.ID</th>
<th>Final Inspection</th>
<th>Complies?</th>
<th>Comments/Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>C303.3, C408.2.5, 2 [FI17]</td>
<td>Furnished O&amp;M instructions for systems and equipment to the building owner or designated representative.</td>
<td>☐ Complies</td>
<td></td>
</tr>
<tr>
<td>C405.4.1 [FI18]</td>
<td>Interior installed lamp and fixture lighting power is consistent with what is shown on the approved lighting plans, demonstrating proposed watts are less than or equal to allowed watts.</td>
<td>☐ Complies</td>
<td>See the Interior Lighting fixture schedule for values.</td>
</tr>
<tr>
<td>C405.5.1 [FI19]</td>
<td>Exterior lighting power is consistent with what is shown on the approved lighting plans, demonstrating proposed watts are less than or equal to allowed watts.</td>
<td>☐ Complies</td>
<td>See the Exterior Lighting fixture schedule for values.</td>
</tr>
<tr>
<td>C406.4 [FI54]</td>
<td>Enhanced digital lighting controls efficiency package: Interior lighting has following enhanced lighting controls in accordance with Section C405.2.2: Luminaires capable of continuous dimming and being addressed individually, &lt;= 8 luminaires controlled in combination in a daylight zone, digital control system for fixtures, &quot;Sequence of Operations&quot; documentation, and functional testing per Section C408.</td>
<td>☐ Complies</td>
<td></td>
</tr>
<tr>
<td>C408.2.5.1 [FI16]</td>
<td>Furnished as-built drawings for electric power systems within 90 days of system acceptance.</td>
<td>☐ Complies</td>
<td></td>
</tr>
<tr>
<td>C408.3 [FI33]</td>
<td>Lighting systems have been tested to ensure proper calibration, adjustment, programming, and operation.</td>
<td>☐ Complies</td>
<td></td>
</tr>
</tbody>
</table>

**Additional Comments/Assumptions:**

1 High Impact (Tier 1)  
2 Medium Impact (Tier 2)  
3 Low Impact (Tier 3)
AGREEMENT made as of the «  » day of «  » in the year «  »
(In words, indicate day, month and year.)

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

«  » «  » «  » «  »
«  » «  » «  » «  »

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

«  » «  » «  » «  »
«  » «  » «  » «  »

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

«  » «  » «  » «  »
«  » «  » «  » «  »

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

«  » «  » «  » «  »
«  » «  » «  » «  »

The Owner and Contractor agree as follows.
TABLE OF ARTICLES

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

EXHIBIT A  INSURANCE AND BONDS

ARTICLE 1  THE CONTRACT DOCUMENTS

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

ARTICLE 2  THE WORK OF THIS CONTRACT

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

ARTICLE 3  DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be:

(Choose one of the following boxes.)

[ ] The date of this Agreement.
[ ] A date set forth in a notice to proceed issued by the Owner.
[ ] 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 of the Work.

§ 3.3 Substantial Completion

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

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

[ ] Not later than ( ) calendar days from the date of commencement of the Work.
§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are
to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial
Completion of such portions by the following dates:

<table>
<thead>
<tr>
<th>Portion of Work</th>
<th>Substantial Completion Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

ARTICLE 4 CONTRACT SUM

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

§ 4.2 Alternates

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

<table>
<thead>
<tr>
<th>Item</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following
execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.

(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

<table>
<thead>
<tr>
<th>Item</th>
<th>Price</th>
<th>Conditions for Acceptance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

(Identify each allowance.)

<table>
<thead>
<tr>
<th>Item</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

§ 4.4 Unit prices, if any:

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

<table>
<thead>
<tr>
<th>Item</th>
<th>Units and Limitations</th>
<th>Price per Unit ($0.00)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

§ 4.5 Liquidated damages, if any:

(Insert terms and conditions for liquidated damages, if any.)

« »

§ 4.6 Other:

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

« »
ARTICLE 5  PAYMENTS
§ 5.1 Progress Payments
§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

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

« »

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the « » day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the « » day of the « » month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than « » (« » ) days after the Architect receives the Application for Payment.
(Federal, state or local laws may require payment within a certain period of time.)

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

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

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

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

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:
.1 The aggregate of any amounts previously paid by the Owner;
.2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;
.3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;
.4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017; and
.5 Retainage withheld pursuant to Section 5.1.7.

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

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

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

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

§ 5.1.8 If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201—2017.

§ 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 Article 12 of AIA Document A201–2017, 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.

§ 5.2.2 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, or as follows:

§ 5.3 Interest
Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.
(Insert rate of interest agreed upon, if any.)

ARTICLE 6 DISPUTE RESOLUTION
§ 6.1 Initial Decision Maker
The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201—2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker.
(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)
§ 6.2 Binding Dispute Resolution
For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:

(Check the appropriate box.)

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

[ ] Litigation in a court of competent jurisdiction

[ ] Other (Specify)

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

ARTICLE 7 TERMINATION OR SUSPENSION
§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017.

§ 7.1.1 If the Contract is terminated for the Owner’s convenience in accordance with Article 14 of AIA Document A201–2017, then the Owner shall pay the Contractor a termination fee as follows:
(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner’s convenience.)

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

ARTICLE 8 MISCELLANEOUS PROVISIONS
§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

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

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

§ 8.4 Neither the Owner’s nor the Contractor’s representative shall be changed without ten days’ prior notice to the other party.
§ 8.5 Insurance and Bonds
§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

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

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, may be given in accordance with AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:
(If other than in accordance with AIA Document E203–2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

« »

§ 8.7 Other provisions:
« »

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS
§ 9.1 This Agreement is comprised of the following documents:
.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor
.2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds
.3 AIA Document A201™–2017, General Conditions of the Contract for Construction
.4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
(Insert the date of the E203-2013 incorporated into this Agreement.)
« »

.5 Drawings

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.6 Specifications

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.7 Addenda, if any:

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

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

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

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Other documents, if any, listed below:

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

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

OWNER (Signature)  
(Printed name and title)

CONTRACTOR (Signature)  
(Printed name and title)
for the following PROJECT:
(Name and location or address)

THE OWNER:
(Name, legal status and address)

THE ARCHITECT:
(Name, legal status and address)

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

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

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

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

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

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

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

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

§ 1.2 Correlation and Intent of the Contract Documents
§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.
§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties’ intentions and purposes in executing the Contract.

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

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

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

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

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

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

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

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

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

§ 1.8 Building Information Models Use and Reliance
Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™. 2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™. 2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party’s sole risk
ARTICLE 2 OWNER
§ 2.1 General
§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner’s approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term “Owner” means the Owner or the Owner’s authorized representative.

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

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

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

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

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

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

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

§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.
§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

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

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

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

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

ARTICLE 3 CONTRACTOR

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

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

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

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

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These
obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor’s review is made in the Contractor’s capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

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

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

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

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

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

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

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

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor’s employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.
§ 3.5 Warranty
§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor’s warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

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

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

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

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

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

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

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

§ 3.8 Allowances
§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.
§ 3.8.2 Unless otherwise provided in the Contract Documents,
1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all
required taxes, less applicable trade discounts;
2 Contractor’s costs for unloading and handling at the site, labor, installation costs, overhead, profit, and
other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but
not in the allowances; and
3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly
by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs
and the allowances under Section 3.8.2.1 and (2) changes in Contractor’s costs under Section 3.8.2.2.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

§ 3.18 Indemnification
§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect’s consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys’ fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent
acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

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

ARTICLE 4 ARCHITECT

§ 4.1 General

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

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

§ 4.2 Administration of the Contract

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

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

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

§ 4.2.4 Communications

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

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

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise
such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

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

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

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

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

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

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

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

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

ARTICLE 5 SUBCONTRACTORS
§ 5.1 Definitions
§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term “Subcontractor” is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term “Subcontractor” does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term “Sub-subcontractor” is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.
§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work
§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

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

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

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

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

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

1. assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and

2. assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

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

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

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor’s obligations under the subcontract.
ARTICLE 6  CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner’s Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term “Separate Contractor(s)” shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner’s own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term “Contractor” in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner’s own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner’s own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

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

§ 6.2.2 If part of the Contractor’s Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor’s Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner’s or Separate Contractor’s completed or partially completed construction is fit and proper to receive the Contractor’s Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor’s delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor’s delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner’s Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.
ARTICLE 7  CHANGES IN THE WORK
§ 7.1 General
§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.2 Change Orders
§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:
   1. The change in the Work;
   2. The amount of the adjustment, if any, in the Contract Sum; and
   3. The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives
§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:
   1. Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
   2. Unit prices stated in the Contract Documents or subsequently agreed upon;
   3. Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
   4. As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:
   1. Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers’ compensation insurance, and other employee costs approved by the Architect;
   2. Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
   3. Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
   4. Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and
   5. Costs of supervision and field office personnel directly attributable to the change.
§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor’s agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor’s agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect’s professional judgment, to be reasonably justified. The Architect’s interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work
The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect’s order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect’s order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME
§ 8.1 Definitions
§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term “day” as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion
§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.
§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time
§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor’s control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION
§ 9.1 Contract Sum
§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values
Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor’s Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor’s subsequent Applications for Payment.

§ 9.3 Applications for Payment
§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor’s right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner’s title to such materials.
and equipment or otherwise protect the Owner’s interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor’s knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor’s Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect’s reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect’s reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect’s evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect’s knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor’s right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect’s opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect’s opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

1. defective Work not remedied;
2. third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
3. failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
4. reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
5. damage to the Owner or a Separate Contractor;
6. reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
7. repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect’s decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

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

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§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor’s portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor’s payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney’s fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor’s Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days’ notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor’s reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.
§ 9.8 Substantial Completion
§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor’s list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect’s inspection discloses any item, whether or not included on the Contractor’s list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use
§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment
§ 9.10.1 Upon receipt of the Contractor’s notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect’s knowledge, information and belief, and on the basis of the Architect’s on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect’s final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor’s being entitled to final payment have been fulfilled.
§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner’s property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers’ warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys’ fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

1. liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
2. failure of the Work to comply with the requirements of the Contract Documents;
3. terms of special warranties required by the Contract Documents; or
4. audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

1. employees on the Work and other persons who may be affected thereby;
2. the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
3. other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

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

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor’s obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor’s organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor’s superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property
If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials and Substances
§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor’s notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor’s reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect’s consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys’ fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property.
(other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor’s fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner’s fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies
In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor’s discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor’s Insurance and Bonds
§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect’s consultants shall be named as additional insureds under the Contractor’s commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor’s Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner’s Insurance
§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to

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provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 Notice of Cancellation or Expiration of Owner’s Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect’s consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect’s consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner’s option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner’s property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner’s property, due to fire or other hazards however caused.

§ 11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner
shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK
§ 12.1 Uncovering of Work
§ 12.1.1 If a portion of the Work is covered contrary to the Architect’s request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect’s examination and be replaced at the Contractor’s expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor’s expense.

§ 12.2 Correction of Work
§ 12.2.1 Before Substantial Completion
The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect’s services and expenses made necessary thereby, shall be at the Contractor’s expense.

§ 12.2.2 After Substantial Completion
§ 12.2.2.1 In addition to the Contractor’s obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

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

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

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

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor’s correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for
correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor’s liability with respect to the Contractor’s obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work
If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS
§ 13.1 Governing Law
The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction’s choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns
§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner’s rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies
§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections
§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner’s expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect’s services and expenses, shall be at the Contractor’s expense.
§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

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

§ 13.5 Interest
Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT
§ 14.1 Termination by the Contractor
§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:
  .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
  .2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
  .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
  .4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days’ notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner’s obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days’ notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause
§ 14.2.1 The Owner may terminate the Contract if the Contractor
  .1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
  .2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
  .3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
  .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor’s surety, if any, seven days’ notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:
.1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
.2 Accept assignment of subcontracts pursuant to Section 5.4; and
.3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the architect’s services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience
§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent
.1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
.2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience
§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner’s convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner’s convenience, the Contractor shall
.1 cease operations as directed by the Owner in the notice;
.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner’s convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES
§ 15.1 Claims
§ 15.1.1 Definition
A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term “Claim” also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims
The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.
§ 15.1.3 Notice of Claims
§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance
§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker’s decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost
If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time
§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor’s Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

§ 15.1.7 Waiver of Claims for Consequential Damages
The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and

2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party’s termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision
§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker...
and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker’s sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner’s expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor’s default, the Owner may, but is not obligated to, notify the surety and request the surety’s assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic’s lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation
§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.
 § 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

 § 15.3.4 The parties shall share the mediator’s fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

 § 15.4 Arbitration
 § 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

 § 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

 § 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

 § 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

 § 15.4.4 Consolidation or Joinder
 § 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

 § 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

 § 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.