NEW BUILDING ADDITION
&
EXISTING BUILDING RENOVATIONS

CAMERON APPRAISAL DISTRICT

SAN BENITO, TEXAS

SPECIFICATIONS

ARCHITECT

K+ ARCHITECT, Inc.
400 E. 3RD ST
LOS FRESNOS, TEXAS 78566
PHONE (956) 233-2218

AUGUST 2018

SET #____

Acknowledgements:
PROJECT DESIGN TEAM & DESIGN COMMITTEE

OWNER
Cameron Appraisal District
2021 Amistad St.
San Benito, Texas 78586
Contact: Richard Molina

PROJECT ARCHITECT
K+ Architect, Inc.
400 E. 3rd St
Los Fresnos, Texas 78566
Contact: Stanford Knowles
Phone: (956) 233-2218

CIVIL ENGINEER
CASA Engineering
1117 N. Stuart Place Rd. Suite E
Harlingen, Texas 78522
Contact: David Day/ JV Garcia
Phone: (956) 428-7900 Fax: (956) 428-7903

STRUCTURAL ENGINEER
CASA Engineering
1117 N. Stuart Place Rd. Suite E
Harlingen, Texas 78
Contact: David Day
Phone: (956) 428-7900 Fax: (956) 428-7903

MEP ENGINEER
Ethos Engineering
119 W. Van Buren Suite 101
Harlingen, Texas 78550
Contact: Cesar Gonzalez
Phone: (956) 230-3435

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ADVERTISEMENT FOR COMPETITIVE SEALED PROPOSALS

Competitive Sealed Proposals for Construction Services for the **Cameron Appraisal District Offices Building Addition and Renovations Project** will be received at the office of Mr. Richard Molina, Chief Appraiser, Cameron Appraisal District, 2021 Amistad Drive, San Benito, Texas 78586 until 4:30 PM Central Standard Time, on **THURSDAY, November 15, 2018**. Proposals must be in compliance with all bid documents, plans and specifications attached to the Request for Competitive Sealed Proposals on file and available by calling (956) 233-2218 or contacting Stanford Knowles at knowlesaia@aol.com or Celia Monreal at celiamonreal@aol.com

This project is subject to the Prevailing Wage Rate. Bids will be received in the Cameron Appraisal District Office and then publicly opened and the names of offerors and monetary proposals read aloud. Any envelopes or packages received after the specified date and time will be returned unopened.

A Mandatory Pre-Proposal Conference and Walk-Through will be held on Wednesday, October 24, 2018 at 4:30 PM Central Standard Time at the Cameron Appraisal District Office at 2021 Amistad Drive, San Benito, Texas 78586.

REQUEST FOR COMPETITIVE SEALED PROPOSALS FOR CONSTRUCTION SERVICES FOR THE THE CAMERON APPRAISAL DISTRICT OFFICES BUILDING ADDITION AND RENOVATIONS PROJECT

SAN BENITO, TEXAS

OCTOBER 2018

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I. BACKGROUND

1. General Description

Cameron Appraisal District invites the submittal of responses to this Request for Proposals (RFP) from qualified firms interested in providing construction services in connection with the construction of the Cameron Appraisal District Offices New Building Addition and Existing Building Renovations Project.

The Project has been designed by **K+ Architect, Inc**. The Project is anticipated to include some or all of the following items within its scope:

- Entire Addition Building including adjacent site work and demolition, including Fire Sprinkler System.
- Renovations to existing building include:
  - Renovations to Existing Building including:
    - Specific demolition related to the following areas of work;
    - ADA Restroom Renovations;
    - Waiting Area, Reception and entry Vestibule Renovations;
    - Door and Door Hardware Replacements;
    - Air Conditioning Unit Replacement, Duct and Controls;
    - Fire Sprinkler System and Replacement of ceiling panels after completed work;
    - Front Parking Lot ADA Changes;
    - Landscape and utilities as described in the plans and specifications;
    - Save and Except Alternates described below, work to include all labor, materials services and equipment, necessary for completion of the work shown on the drawings and described in the specifications. Base Bid does not include the security and camera installation that will be required to be coordinated by General Contractor. The Data and Intercom work shall be included in the General Contract.

Responses are solicited for this service in accordance with the terms, conditions, and instructions set forth in the RFP guidelines.

2. Purposes of RFP

Cameron Appraisal District ("CAD") issues this RFP seeking competitive sealed proposals in accordance with Chapter 2269 of the Texas Government Code for the construction of a project further described in Section III, Scope of Work.

CAD seeks the respondent who provides the best value for CAD based on (1) the selection criteria and the weighed value for those criteria and (2) the ranking evaluation.

3. Location

The facility will be located at the Cameron Appraisal District Offices site at 2021 Amistad Drive, San Benito, Texas 78586.

4. Project Duration

CAD has established a target commencement date for construction activities as on or before **February 1, 2019**. The projected completion date for the **Addition Building** is estimated to be **One Hundred Eighty (180) days from the date of commencement**. The projected completion date for the **entire Work** is estimated to be **Two Hundred Seventy (270) days from the date of commencement**. CAD reserves the right to phase the construction of the Project or modify the schedule as needed and determined by the CAD Board of Directors or staff due to modifications in scope. Additionally, and without limiting the foregoing, CAD reserves the right to issue a Notice to Proceed for up to ninety (90) after award.

5. Project Budget

Estimated maximum construction budget is approximately **One Million and no/100 Dollars ($1,000,000.00)**. This includes all incidental and contingent expenses associated with the construction of the Project.

6. **To Be Opened**
CAD will be accepting sealed proposals until **November 15, 2018 at 4:30 P.M.,** at which time they will be opened publicly and the name of the offeror and the monetary component of the proposals shall be read aloud. Any proposal received after bidding time will be returned unopened. Receipt of response does not bind CAD to any contract for said services, nor does it give any guarantee that a contract for the Project will be awarded.

Proposal forms, contract documents, and construction plans and specifications can be obtained by (956) 233-2218 or contacting Stanford Knowles at knowlesaias@aol.com or Celia Monreal at celiamonreal@aol.com.

Offerors shall return **one (1) clearly marked original, two (2) clearly marked copies, and a thumb drive with electronic copies of all documents included in the proposal in PDF file format** of their proposals to: **Mr. Richard Molina, Chief Appraiser, Cameron Appraisal District, 2021 Amistad Drive, San Benito, Texas 78586**, in an envelope or package no smaller than 8-1/2" X 11" and clearly marked in the lower left hand corner:

SEALED PROPOSAL
Submitting Company Name: _____
Cameron Appraisal District Offices Building Addition and Renovations Project.
Cameron Appraisal RFP
November 15, 2018 at 4:30 P.M.

7. **Mandatory Pre-proposal**
A Mandatory pre-proposal conference for all interested parties will be held at the Project site, **2021 Amistad Drive, San Benito, Texas 78586** on **October 24, 2018 at 4:30 P.M**. All offerors interested in submitting a proposal for this work must be present at this meeting. CAD will conduct site visits immediately following this meeting. Attendance will be taken at each site visit. CAD cannot accept a proposal from an offeror that does not attend this mandatory meeting and the site visits.

8. **Bid Bond**
Each proposal must be accompanied by an approved Bid Bond on the form provided in the amount of **5%** of the proposal cost, payable to the Cameron Appraisal District without recourse, as a guarantee respondent will enter into a contract at the stated price. The successful respondent must execute 100% performance and payment bonds on the forms provided with this RFP, within ten (10) days after the contract has been awarded.

9. **Rights Reserved**
Proposals shall remain open and may be held by CAD for ninety (90) days for full evaluation and ranking of offerors. Based on its sole discretion, CAD reserves the right to determine the propriety of any proposal and may disqualify any respondent based on an incomplete, inaccurate, or noncompliant response. The Board of Directors of the CAD reserves the right to reject any or all of the proposals, to waive formalities, and to make an award to an Offeror in the order of ranking as outlined in this RFP and that the Board of Directors determines will be the best value to the CAD. Respondents will be notified in writing of any determinations made by CAD or its Board of Directors pursuant to this section.

10. **Disclosure**
The State of Texas Local Government Code (Chapter 176) requires that all vendors seeking to do business with CAD will file a disclosure questionnaire identifying any business relationship they

have with a Board of Director member or the Chief Appraiser . For more information or to obtain the Questionnaire CIQ, go to the Texas Ethics Commission web page at: www.ethics.state.tx.us/forms/CIQ.pdf The disclosure questionnaire **must be submitted with your Proposal**.

11. Certificate of Interested Parties

State of Texas Local Government Code (Chapter 2252) states that CAD may not enter into a contract with a business entity unless and until the business entity has submitted a Certificate of Interested Parties (hereafter referred to as "Form 1295") to CAD for filing with the Texas Ethics Commission (hereafter referred to as "TEC"). Instructions for completing this form are included at https://www.ethics.state.tx.us/whatsnew/elf_info.form1295.htm. Form 1295 **must be submitted with your Proposal**.

12. Questions and Addenda

Questions regarding this RFP or the services requested must be sent to the Stanford Knowles of K+ Architect, Inc. (the "Architect's Representative") at knowlesais@aol.com or (956) 233-2218 **before November 9, 2018 at 4:30 P.M.** Any changes, additions, or clarifications to the RFP are made by amendments (addenda) and will be posted on the public purchase website. Any respondent in doubt as to the true meaning of any part of the RFP or other documents may request an interpretation from the Architect's Representative. At the request of the respondent, or in the event the Architect's Representative deems the interpretation to be substantive, the interpretation will be made by written addendum issued by the Architect's Representative. Such addendum will be attached to the original RFP in the public purchase file and will become part of the RFP package having the same binding effect as provisions of the original RFP. It shall be the respondent(s) responsibility to ensure that they have received all Addenda with respect to this Project. Furthermore, respondents are advised that they must recognize, comply with, and attach a signed copy of each Addendum, which shall be made part of their submittal. Respondent(s) signature on Addenda shall be interpreted as the respondent's recognition and compliance to official changes as outlined by CAD and as such are made part of the original RFP documents. Failure of any respondent to receive any such addendum or interpretation shall not relieve such Respondent from its terms and requirements. Addendums will be provided to by K+ Architect, Inc. No verbal explanations or interpretations will be binding. CAD does not assume responsibility for the receipt of any addendum sent to respondents.

II. OBJECTIVES

CAD proposes to retain a highly qualified, capable firm to act as its general contractor for the construction of the Project. Firms who participate in this RFP process are sometimes referred to as "Bidders," "Respondents," and "Offerors." Owner will give prime consideration to the Offerors with significant, current experience in the management and construction of similar projects. Experience in construction of similar types of projects is essential. Pursuant to its statutory authority, Owner reserves the right to negotiate with a selected Respondent but shall not be obligated to enter into any contract with any Respondent on any terms or conditions.

III. SCOPE OF WORK

Owner anticipates the scope of work to consist of the following responsibilities:

CAD anticipates the following items will be included in the scope of the Cameron Appraisal District Offices Building New Addition and Existing Building Renovations Project:

- Complete construction for Cameron Appraisal Building New Additions including but not limited to: Site work, Concrete sidewalls, Landscaping, Gates, Fencing, Demolition, Concrete Foundation, Structural Steel frame with Bar Joists and misc steel, Single Ply Roof, Metal Canopies, Concrete Masonry Unit walls, metal stud frame walls, stucco walls, densglass sheathing, Tyvek exterior spray applied damproofing, gypsum board sheathing, insulation, painting, aluminum windows, storefront glass and doors, metal and wood doors, metal frames, cabinetry, suspended acoustical ceiling, vinyl composition tile floor, ceramic tile floors, utility service installation for complex including: HVAC systems, electrical systems, telephone, fire alarm, fire sprinkler system, security, data system, water and wastewater systems
- Specific Renovations to Existing Cameron Appraisal Building including but not limited to: Site work, Concrete sidewalks, Landscaping, Gates, Fencing, Demolition, Concrete Foundation, Structural Steel Frame with Bar Joists and misc steel, Asphaltic Built Up Roof Repairs, Metal Canopies, Standing Seam Metal Roof, Concrete Masonry Unit walls, metal stud frame walls, stucco walls, densglass sheathing, tyvek exterior spray applied damproofing, gypsum board sheathing, insulation, painting, aluminum windows, bulletproof glass, storefront glass and doors, metal and wood doors, metal frames, cabinetry, suspended acoustical ceiling, ceramic tile floors, vinyl composition tile floor, utility service installation for complex including: HVAC systems, electrical systems, telephone, fire alarm, fire sprinkler system, security, data system, water and wastewater systems.

- All other material procurement, purchasing, demolition, renovation, construction, installation, testing and associated services as described in the construction plans and specifications for the Project.

The Project will be designed and constructed so as to meet all applicable federal, state, and local accessibility standards.

The selected Offeror will be also responsible for: obtaining all applicable permits and inspections; providing all necessary performance and payment bonds and insurance certificates; and providing the Owner with all manufacturers' warranties and all operations and maintenance (O & M) manuals for all equipment installed.

The selected Offeror may be required to perform some or all of the following pre-construction and construction services. Preconstruction Services may include, but not necessarily be limited to, planning and value engineering the Work. Construction Services may include, but not necessarily be limited to, all work associated with construction, occupancy and warranty of the facilities.

CAD has obtained a Geotechnical Report from Raba-Kistner, dated [insert date] (the "Geotechnical Report") regarding geotechnical data on the Project site. A copy of the Geotechnical Report is provided to Respondents for informational purposes only with this Request for CSPs. The Geotechnical Report is not a part of the Contract Documents. Provision of the Geotechnical Report does not modify, alter or change and rights between CAD and the selected Respondent under the Contract Documents, nor does it give rise to any claim or cause of action by Respondent against CAD. CAD, the Architect and Engineer disclaim any liability for use or interpretation of the Geotechnical Report in connection with the Project, and each make no representations or warranties to Respondents regarding the accuracy of the information contained therein.

IV. SELECTION PROCESS

Respondents should prepare a sealed proposal responsive to all information requested in this RFP.

CAD will use a selection committee to evaluate the proposals. CAD will select the offeror that submits the proposal that offers the best value for the Owner based on the criteria in this request and its ranking evaluation. The response received will be part of the selection process utilized by Owner. Owner reserves the right to and may contact Offerors with questions or clarifications relating to that Offeror's response to this RFP.

The Owner's selection committee will rank the Offerors and will notify each of the rankings within 45 days of proposal opening. The Owner will then negotiate with the highest ranked Offeror as allowed by statute. The set of Contract Documents, including the forms for the Contract Agreement between Owner and Contractor, the Standard General Conditions of the Contract, the Insurance Rider (the terms of which are set forth in **Exhibit B**), the requisite bond forms, and the Drawings and Specifications are included with this RFP for Offeror evaluation prior to submission of a Proposal. If a contract cannot be successfully negotiated with the highest ranked Offeror, in the opinion of Owner, negotiations will be terminated and Owner will proceed to negotiate with the next highest ranked Offeror in the order of the selection ranking until a mutually agreed contract can be negotiated or all proposals are rejected.

V. SELECTION CRITERIA

The selection criteria used to evaluate the RFP responses will include, but not be limited to, the following (items listed below are not listed in order of importance):

1. The Cost of the Work (weighted at 25%).
2. Proposed Schedule/Contract Time (weighted at 10%).
3. Past Performance on Similar Projects. The qualifications, reputation, capability and past performance of the contractor and the contractor's subcontractors and suppliers (to the extent identifiable at the time of proposal submission) on improvement projects of similar size and scope (weighted at 20%).
4. Overall Qualifications, Reputation, Past Relationship with CAD and Public Owners. This includes the qualifications, reputation, capability, safety record, financial capability, and contractor's past relationship and experience with CAD or other public entities (weighted at 15%).
5. The available resources to complete the project. This criterion would include personnel, percentage of work to be self-performed, resources and methodologies commonly used by your firm that may be applicable to the project categories (weighted at 10%).
7. The Contractor's corporate history and stability. This criterion includes the historical stability, corporate structure, history of litigation or arbitration, and a statement of any liquidated damages that have previously been withheld by public owner clients of the Offeror on projects in the last five (5) years. (weighted at 15%).
8. References (weighted at 5%).

Offerors shall include with the proposal all information and qualifications to allow CAD's selection committee to evaluate the proposal in accordance with this section and the evaluation

criteria listed here, including without limitation, at least three (3) references, a list of known subcontractors and suppliers, and identification of work to be self performed. CAD reserves the right to request additional post-proposal information from any or all Offerors to assist in evaluating the proposal based on the selection criteria. The Owner reserves the right to reject any and all proposals. The Owner reserves the right to waive any and all irregularities in proposals.

Proposal shall include all specified items in this section and be placed in envelopes furnished by respondent, sealed and clearly identified on outside as a Proposal to Owner, with respondent's name and address, and project name. Failure to submit Proposal in these envelopes may subject respondent to disqualification. Proposal must be delivered in person, by United States Mail, or by private courier service to the addressee listed in Section I.6 of this Request for CSPs.

When sent by in person, by United States Mail, or by private courier service, sealed Proposal (marked as indicated above) shall be enclosed in an additional envelope clearly identified on outside as a Proposal to Owner with respondent's name and address, Project name, and RFP date and time. It is the sole responsibility of respondent to ensure timely delivery of Proposal. Owner will not be responsible for failure of service on the part of the U.S. Post Office, courier services, or any other form of delivery service chosen by respondent.

Each Proposal, completed and signed by person(s) authorized to bind individual, partnership, firm, corporation, or any other legal entity, shall include the following in one envelope furnished by respondent:

- One (1) clearly marked original, two (2) copies, and a thumb drive with electronic copies of all documents included in the proposal in PDF file format of their proposals.
- One copy of Bid Form completed and signed.
- Acknowledgment of receipt of Addenda issued
- Required bid guaranty.
- Copy of Articles of Incorporation, Partnership Agreements and resolution or board minutes empowering signatory to bind respondent, attested by an officer of respondent.
- One copy of Insurance, completed and signed.
- Questionnaire CIQ and Form 1295
- Other Required information indicated in Drawings or Contract Documents.

Proposal shall include all specified items in this section. Failure to submit proposal or any required item may subject respondent to disqualification.

VI. ADDITIONAL INSTRUCTIONS, NOTIFICATIONS, AND INFORMATION

1. All Information True

Respondent represents and warrants to Owner that all information provided in the response shall be true, correct and complete. Respondents who provide false, misleading, or incomplete information, whether intentional or not, in any of the documents presented to Owner for consideration in the selection process shall be excluded.

2. Inquires

Do not contact Owner during the selection process to make inquiries about the progress of this selection process. Such contact may result in disqualification. Respondents will be contacted when it is appropriate to do so.

3. **Cost of Responses**
   Owner will not be responsible for the costs incurred by anyone in the submittal of responses.

4. **No Obligation**
   By publishing this RFP, Owner is under no obligation to enter into a contract with any respondent and reserves the right to cancel the entire process.

5. **Contract Negotiations**
   This RFP is not to be construed as a contract or as a commitment of any kind. If this RFP results in a contract offer by Owner, the specific scope of work, associated fees, and other contractual matters will be determined during contract negotiations. Notwithstanding the foregoing, the selected Respondent will be required to perform the work pursuant to the terms of the Construction Contract. A copy of the Owner's proposed Construction Contract is included with this RFB in Division 00500. The Respondent who is awarded the Project will be required to enter into the Construction Contract identified herein without substantial modification, except as otherwise agreed by Owner. By submitting a proposal, Respondents agree to this condition (subject to any specific qualifications or exceptions set out in the Bidder's proposal) and Owner will rely upon the Respondent's agreement regarding the Construction Contract when evaluating which proposal to select.

6. **Statement of Statutory Compliance**

   Pursuant to section 2270.002 of the Texas Government Code, all Offerors submitting a proposal in response to this RFP must include with the proposal a verified statement that the Offeror does not boycott Israel and will not boycott Israel during the term of the Project if the contract is awarded to the Offeror. Failure to comply with this requirement is grounds for disqualification; however, CAD reserves the right to contact any Offeror who fails to comply initially to correct the omission or to confirm the Offeror's policy.

7. **Prohibition on Contracts with Certain Companies**
   CAD will review the website of the Comptroller of the State of Texas to determine if the respondent is on the list of companies that provide supplies or services to a foreign terrorist organization as defined in Chapter 2252 of the Texas Government Code, as amended. Any company identified on such list will be disqualified from consideration.

8. If not selected, respondent shall promptly delete or destroy copies of the Drawings, Specifications and any other Construction Documents provided to Respondent in connection with this Request for Competitive Sealed Proposals.

VII. INSURANCE AND BONDS

Respondents must be able to provide the insurance required in **Exhibit B** and comply with the terms in **Exhibit B** governing such insurance. Additionally, Respondents must provide payment and performance bonds in the form attached as **Exhibit A**.

END OF DOCUMENT

SECTION 00220

GEOTECHNICAL DATA

1.01 GEOTECHNICAL DATA

A. The Owner has contracted with the firm of Raba-Kistner for determination of geotechnical data on the project site.
B. The report is entitled ----------

1.02 AVAILABILITY

A. **A** copy of the report is available at the office of the Architect.
B. Reproductions of the report are available from the Architect for the cost of reproduction and mailing or delivery.

1.03 DISCLAIMER

A. The report shall not be considered a part of the Contract Documents for the Project.
B The Owner, Architect, and Engineer disclaim any liability for use of or interpretation from the geotechnical report on the Project.

END OF DOCUMENT

Cameron Appraisal District
2021 Amistad Drive
San Benito, Texas 78586,

PROJECT: **CAMERON APPRAISAL DISTRICT OFFICES BUILDING ADDITION AND RENOVATIONS PROJECT**

1. The undersigned RESPONDENT proposes and agrees, if this bid is accepted, to enter into an agreement with the Cameron Appraisal District ("CAD") in the form included in the Specifications, Division 0, Section 00500 the General Conditions thereto in Division 0, Section 00700 and to perform and furnish all Work as specified or indicated in the Contract Documents for the Contract Price and within the Contract Time indicated in this Bid and in accordance with the other terms and conditions of the Contract Documents.
2. RESPONDENT accepts all the terms and conditions of the Request for Competitive Sealed Proposals, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for ninety (90) days after the day of Bid opening. RESPONDENT will sign and submit the Agreement with the Bonds and other Documents required as specified in the Bidding Documents within ten (10) days after the date of CAD's Notice of Award,
3. In submitting this bid, RESPONDENT represents, as more fully set forth in the Agreement, that:
   a) RESPONDENT has examined copies of all the Bidding Documents and of all addenda.
   b) RESPONDENT has familiarized himself/herself with the nature and extent of the Contract Documents, Work, site, locality and all local conditions and Laws and Regulations that in any manner may affect cost, progress, performance or furnishing of the work.
   c) RESPONDENT has obtained and carefully studied (or assumes responsibility for obtaining and carefully studying) all such examinations, investigations, explorations, tests and studies which pertain to the subsurface of physical conditions at the site or otherwise may affect the cost, progress, performance or furnishing of Work as RESPONDENT considers necessary for the performance or finishing of the Work at the Contract Price, within the Contract Time and in accordance with the other terms and conditions of the Contract Documents, including specifically the provisions of Article 3 of the General Conditions; and no additional examinations, investigations, explorations, tests, reports, or similar information or data are or will be required by RESPONDENT for such purposes.
   d) RESPONDENT has reviewed and checked all information and data shown or indicted on the Contract Documents with respect to existing Underground Facilities at or contiguous to the site and assumed responsibility for the accurate location of said Underground Facilities. No additional examinations, investigations, explorations, tests, reports or similar information or data in respect of said Underground Facilities are or will be required by the RESPONDENT in order to perform and furnish the Work at the Contract Price, within the Contract Time and in Accordance with the other terms and conditions of the Contract Documents, including specifically the provisions of Article 3 of the General Conditions.
   e) RESPONDENT has correlated the results of all such observations, examinations, investigations, explorations, tests, reports, and studies with the terms and conditions of the Contract Documents.
   f) RESPONDENT has given OWNER written notice of all conflicts, errors or discrepancies that it has discovered in the Contract Documents and the written resolution thereof by OWNER is acceptable by RESPONDENT.
   g) The Bid is genuine and not made in the interest of or on behalf of any undisclosed person, firm, or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; RESPONDENT has not directly or indirectly induced or solicited any other RESPONDENT to submit a false or sham Bid; RESPONDENT has no solicited or induced any person, firm or corporation to refrain from bidding; and RESPONDENT

has not sought by collusion to obtain for itself any advantage over any other RESPONDENT or over CAD.

4. RESPONDENT will complete work for the following prices:

   Base Bid for General Contract for the stipulated sum of:

   _____ Dollars

   ($_____)

   Alternate #1 Bid for Existing Building Roof Repairs including metal flashings and Additional Built-up Asphalt and Gravel Roof and Flashings as Specified (flashing required for replacement of AC Unites included in Base Bid) for the stipulated sum of:

   _____ Dollars

   ($_____)

   Alternate #2 Bid for Lighting Replacement in Existing Building including light fixtures, switches and wiring and associated materials in areas not renovated as Specified for the stipulated sum of:

   _____ Dollars

   ($_____)

   Alternate #3 Bid for Existing Building Door Handles and Lockset Replacements and Specialty Hardware as Specified for the stipulated sum of:

   _____ Dollars

   ($_____)

   Alternate #4 Bid for Existing Rear Parking Area South Entrance Concrete and Base Replacement with 6" Concrete paving and Addition of Dumpster Pad as Specified for the stipulated sum of

   _____ Dollars

   ($_____)

5. RESPONDENT acknowledges that the descriptions of bid items above is for informational and organizational purposes only. RESPONDENT affirmatively represents to OWNER that the TOTAL BASE BID + ADD/ALTERNATES includes all of the Work required for the Project and as depicted in the Construction Documents provided with the Bidding Documents.
6. RESPONDENT agrees that the Work will achieve Substantial Completion and ready for final payment in accordance with paragraph 9.9.1 of the General Conditions within the Calendar days indicated in the Agreement, respecting the requirement to finish the Addition before specific portions

of the Renovations on Existing Building as explained in the Bid Documents. RESPONDENT accepts the provisions of the Agreement as to liquidated damages and special damages in the event of failure to complete the Work on time.

6. The following documents are attached to and made a condition of this Bid:
   a) Required Bid Security of five percent (5%) of the Bidder's maximum base bid price and in the form of approved bid bond.
7. Communication concerning this Bid shall be addressed to:
   Cameron Appraisal District
   c/o K+ Architect, Inc.
   Attn: Stanford Knowles
   knowlesais@aol.com
   (956) 233-2218
8. The terms used in this Bid which are defined in the General Conditions of the Construction Contract included as part of the Contract Documents have the meanings assigned to them in the General Conditions.
9 The undersigned acknowledges receipt of the following addenda:

Addendum No. 1 dated _____ Received _____
Addendum No. 2 dated _____ Received _____
Addendum No. 3 dated _____ Received _____

I, _____, an authorized representative of _____ (the "Respondent"), submitting a proposal in response to this RFP, have read and fully understand the terms of the RFP. Additionally, Respondent hereby declares that it does not boycott Israel and will not boycott Israel during the term on the Agreement with San Felipe if it awarded the Project, as described in Chapter 2270 of the Texas Government Code, as amended. Respondent further declares that it does not have a contract with or provide supplies or services to a foreign terrorist organization as defined in Chapter 2252 of the Texas Government Code, as amended.

Signature: _____
(Sign on line above)

Name (Print):

Title:

Company:

Phone:

Date:

_____
Secretary, *if bidder is a corporation

_____
Company Name of Bidder

(Seal)

_____
Authorized Signature

_____
Date

_____
Printed Name of Authorized Signature

Copy of Corporate Resolution and minutes with certificate of officer of bidder as to authority of signatory to bind bidder is to be signed and dated no earlier than one week before bid date, and attached to this document

_____

_____
Address

_____
Telephone Number/Fax Number

END OF DOCUMENT

PAYMENT BOND

THE STATE OF TEXAS §
§ KNOW ALL BY THESE PRESENTS:
COUNTY OF _____ §

That we, _____, as Principal herein, and (2) _____ _____, a corporation organized and existing under the laws of the State of Texas and who is authorized and admitted to use surety bonds in the State of Texas, as surety, are held and firmly bound unto the Cameron Appraisal District so located in Cameron County, Texas, Obligee herein, in the amount of _____ Dollars ($_____) for the payment whereof, the said Principal and Surety bind themselves and their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents:

WHEREAS, the Principal has entered into a certain written contract with the Obligee dated the _____day of _____, 20___, which contract is hereby referred to herein as "the Contract" and is incorporated herein to the same extent as if copied at length, for the following project: Cameron Appraisal District Offices Building Addition and Renovations Project.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said Principal shall directly or indirectly timely make payment to each and every claimant (as defined in Chapter 2253, Texas Government Code, as amended) supplying labor or materials in the prosecution of the work under the Contract, then this obligation shall be void; otherwise, to remain in full force and effect. *This obligation may be enforced by the Obligee in the event of bankruptcy or default by Principal in payments to suppliers of labor or materials in the prosecution of the work under the Contract, in either of which events the Surety shall make such payments as Principal has failed to pay and as may be required to complete the work under the contract.* The Surety stipulates and agrees that no change, extension of time, alteration, omission, addition or other modification to the terms of the Contract will affect its obligations on this bond, and it hereby waives notice of any such changes, extensions of time, alterations, omissions, additions, or other modifications, to the Contract or to related subcontracts, purchase orders or other obligations, and any notices provided in such regard shall not create as to any party a duty related thereto.

PROVIDED, HOWEVER, that this bond is executed pursuant to Chapter 2253 of the Texas Government Code, as amended, and all rights and liabilities on this bond shall be

determined in accordance with the provisions of said statute, to the same extent as if it were copied at length herein. All notices shall be delivered in writing to the addresses shown below or to addresses provided in the Contract Documents.

IN WITNESS WHEREOF, the duly authorized representatives of the Principal and the Surety have executed this instrument.

SIGNED and SEALED this _____ day of _____, 20___.

The date of bond shall not be prior to date of Contract.

_____
PRINCIPAL

ATTEST: By: _____

_____ Name: _____
(Principal) Secretary

Title: _____

(S E A L) Address: _____
_____
_____

_____
Witness as to Principal

Telephone Number: _____

_____
SURETY

ATTEST: By: _____

_____ Name: _____
Secretary Attorney in Fact

(S E A L) Address: _____
_____
_____

_____
Witness as to Surety Telephone Number: _____

An original copy of Power of Attorney shall be attached to Bond by the Attorney-in-Fact.

Approved as to Form:

Cameron Appraisal District
2021 Amistad Dr.
San Benito, Texas 78586

By: _____

Title: _____

Date:_____

PERFORMANCE BOND

THE STATE OF TEXAS §
§ KNOW ALL BY THESE PRESENTS:
COUNTY OF _____ §

That we, [Contractor], as Principal herein, and [Surety], a corporation organized and existing under the laws of the State of [Surety's state of incorp], and who is authorized and admitted to issue surety bonds in the State of Texas, Surety herein, are held and firmly bound unto Cameron Appraisal District, located in Cameron County, Texas, Obligee herein, in the sum of [verbal amount of bond] Dollars ($[numeric amount of bond]) for the payment of which sum we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, Principal has entered into a certain written contract with the Obligee dated the ____day of _____, 20___, herein referred to as "the Contract" and incorporated herein and made a part hereof for all purposes, for the construction of Cameron Appraisal District Offices Building Addition and Renovations Project.

NOW, THEREFORE, the condition of this obligation is such, if the said Principal shall faithfully perform the work in accordance with the plans, specifications, and other Contract Documents and shall fully indemnify and hold harmless the Obligee from all costs and damages which Obligee may suffer by reason of Principal's failure to perform the Work in conformity with the Contract Documents, and reimburse and repay Obligee for all outlay and expense that Obligee may incur in making good such default, then this obligation shall be void; otherwise, to remain in full force and effect. Whenever Contractor shall be declared by Obligee to be in default under the Contract, the Surety shall, upon request of Obligee and within seven (7) calendar days from receipt of Obligee's notice of Contractor's default, commence and thereafter complete performance of Contractor's obligations under the Contract. This Bond covers all contractual obligations of Contractor under the Contract, including, without limitation, the indemnity, warranty and guaranty obligations. The Surety stipulates and agrees that no change, extension of time, alteration, omission, addition or other modification to the terms of any of the Contract will affect its obligations on this bond, and it hereby waives notice of any such changes, extensions of time, alterations, omissions, additions, or other modifications, to the Contract or to related subcontracts, purchase orders or other obligations, and any notices provided in such

regard shall not create as to any party a duty related thereto. The penal limit of this bond shall automatically be increased by the amount of any change order, supplemental agreement or amendment which increases the price of the Contract.

PROVIDED, HOWEVER, that this bond is executed pursuant to Chapter 2253 of the Texas Government Code, as amended, and all rights and liabilities on this bond shall be determined in accordance with the provisions of such statute, to the same extent as if it were copied at length herein. All notices shall be delivered in writing to the addresses shown below or to addresses provided in the Contract Documents.

IN WITNESS WHEREOF, the duly authorized representatives of the Principal and the Surety have executed this instrument.

SIGNED and SEALED this _____ day of _____, 20___.

The date of bond shall not be prior to date of Contract.

_____
PRINCIPAL

ATTEST:

By: _____

_____
(Principal) Secretary

Name: _____

Title: _____

(S E A L)

Address: _____

_____

_____

_____
Witness as to Principal

Telephone Number: _____

_____
SURETY

ATTEST:

By: _____

_____
Secretary

Name: _____
Attorney in Fact

(S E A L)

Address: _____

_____

_____

Witness as to Surety

Telephone Number: _____

An original copy of Power of Attorney shall be attached to Bond by the Attorney-in-Fact.

Approved as to Form:

Cameron Appraisal District
2021 Amistad Dr.
San Benito, Texas 78586

By: _____

Title: _____

Date: _____

DRAFT

AIA® Document A101™ – 2007

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

AGREEMENT made as of the « » day of « » in the year « 2018 »
(In words, indicate day, month and year.)

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

« Cameron Appraisal District»« »
« 2021 Amistad Drive»
« San Benito, Texas 78586»
« »

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

« »

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

«Cameron Appraisal District Offices
Building Addition and Renovations Project »
«2021 Amistad Drive »
San Benito, Texas 78586 »

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

«K+ Architect, Inc.
400 East Third Street
Los Fresnos, Texas 78566»
« Attn: Stanford Knowles»
« 956.233.2218 »
« »

The Owner and Contractor agree as follows.

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

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

AIA Document A201™–2007, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

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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

Unless otherwise provided in these Contract Documents, the Contractor shall be responsible for performing or causing to be performed all Work including labor and materials, necessary to build, construct, erect and equip in accordance with the Contract Documents except to the extent 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 stated in a Notice to Proceed issued by the Owner.

If, prior to the commencement of the Work, the Owner requires time to file mortgages and other security interests, the Owner's time requirement shall be as follows:

« N/A »

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

§ 3.3 The Contractor shall achieve Substantial Completion of the entire Work not later than «Two Hundred Seventy » («270») calendar days from the date of commencement subject to adjustments of this Contract Time as provided in the Contract Documents.

§ 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:

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Portion of Work	Substantial Completion Date
Building Addition	One Hundred and Eighty (180) calendar days from the date of commencement

§ 3.3.3 If the Contractor fails to achieve Substantial Completion of the entire work as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5. No liquidated damages shall be assessed for Contractor's failure to achieve Substantial Completion of the Building Addition within the time specified in Section 3.3.3.

§ 3.4 In all matters of this Agreement, Time is of the essence in all phases of the Work and performance of obligations owed by the Contractor to the Owner as stated in this Agreement and the Contract Documents. It is specifically understood and agreed by and between Owner and Contractor that time is of the essence in the substantial completion of the Work, and that failure to substantially complete the Work within the designated period, or as it may be extended, shall be construed as a breach of this Agreement. Contractor acknowledges and agrees that that the Schedule of Work attached hereto as **Exhibit B** will reflect and accommodate allowed working days and times and any restricted days on which Contractor may not performed work. Information regarding allowed working days and times or restricted work days will be provided by Owner or Architect.

§ 3.4.1 The Contractor acknowledges and recognizes that the Owner is entitled to full and beneficial occupancy and use of the completed work during construction (as applicable) and following expiration of the Contract Time. The Contractor further acknowledges and agrees that, if the Contractor fails to substantially complete, or cause the Substantial Completion of any portion of the Work within the Contract time, the Owner will sustain actual damages as a result of such failure. The exact amount of such damages will be difficult to ascertain. Therefore, the Owner and Contractor agree that, if the Contractor shall neglect, fail, or refuse to achieve substantial completion of the Work by the Substantial Completion date, subject to proper extension granted by the Owner, then the Contractor agrees to pay the Owner the sum of

Five Hundred and no/100 Dollars ($500)

per each calendar day in which such Work is not completed, not as penalty, but as liquidated damages, for the damages ("Liquidated Damages") that would be suffered by Owner as a result of delay for each and every calendar day that the Contractor shall have failed to have completed the Work as required herein. The Liquidated Damages shall be in lieu of any and all other damages which may be incurred by Owner as a result of the failure of Contractor to complete within the Contract Time.

§ 3.5 Adverse weather conditions are not anticipated to impact the progress of the Contractor's Work (allowance has been made in the Contractor's Schedule of the Work attached hereto as **Exhibit B** for weather conditions, other than delay due to adverse weather conditions abnormal for the period of time). However, Contractor will record on a daily basis whether its job progress has been materially affected by adverse weather conditions. Notwithstanding the foregoing, it is expressly understood that no application will be made for extension of the Contract Time for delay due to weather conditions abnormal for the period of time unless the critical path of the Project is materially affected. The Contractor will provide a written explanation and other evidence requested by Owner evidencing such impact has occurred. Contractor shall notify Owner of any such delay promptly in writing, and on a monthly basis submit a report to the Owner substantiating any days claimed to have been lost, over and above those allotted for in the Contractor's Schedule of the Work, due to adverse weather conditions abnormal for the period of time. The Contractor shall bear the entire economic risk of all weather delays and disruptions, including adverse weather conditions abnormal for the period of time, and shall not be entitled to any increase in the Contract Sum by reason of such delays or disruptions.

For purposes hereof, weather conditions are "abnormal for the period of time" to the extent that the cumulative number of days of delay to the critical path for the respective month as a result of precipitation or subsequent muddy conditions exceeds the weather days set forth in the table below. No day on which substantial Contractor forces are able to perform critical path work on the Project for more than fifty percent (50%) of the usual workday will be counted as a day of delay.

Average Weather Days per Month

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Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
3	3	2	2	3	4	3	3	7	4	3	3

The number of rain days shown in the Average Weather Days per Month Table for the first and last months of this Agreement will be prorated in determining the total number of rain days expected during the period of this Agreement.

Requests for an extension of the Contract Time pursuant to this subsection shall be promptly submitted to the Owner in writing. Failure to timely submit a complete notice of claim for delays and extension of the Contract Time due to adverse weather conditions abnormal for the period of time in accordance with this Section shall result in the denial of a request for extra time for performance under the Contract Documents.

For the duration of the Contract, the Contractor shall maintain in its daily reports an accurate and contemporaneous record of the occurrence of adverse weather and resultant impact to normally scheduled Work. The number of actual adverse weather days shall be calculated monthly. If the number of the actual adverse weather delay days in a month exceed the number of days for that month as shown in the Average Weather Days per Month Table above, the Architect upon notification by the Contractor, will convert any qualifying delays to calendar days, giving full consideration for equivalent fair weather work days, and a modification shall be issued in accordance with the Contract.

§ 3.6 FINAL COMPLETION

§ 3.6.1 Timely final completion is an essential condition of this contract. Contractor agrees to achieve final completion of the Work within 30 days of the designated or extended substantial completion date.

§ 3.6.2 Final Completion means actual completion of the Work, including any punch list items, extras or Change Orders reasonably required or contemplated under the Contract Documents other than warranty work that may be required pursuant to Section 3.5 of AIA Document A201-2007 as amended.

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 The Contract Sum is based upon the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner:
(State the numbers or other identification of accepted alternates. If the bidding or proposal documents permit the Owner to accept other alternates subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date when that amount expires.)

« »

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

Item	Units and Limitations	Price Per Unit ($0.00)
« »		

§ 4.4 Allowances included in the Contract Sum, if any:
(Identify allowance and state exclusions, if any, from the allowance price.)

Item	Price
« »	

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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.

§ 5.1.3 The Owner will pay an approved Application for Payment within thirty (30) days after the date such approved Application for Payment is received by the Owner from the Architect. Not withstanding the foregoing the Owner shall not be required to pay any disputed amounts that the Owner believes were erroneously approved by the Architect. Past due payments and any disputed amounts shall bear interest in accordance with the Texas Prompt Payment Act.

§ 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 and Owner may require. This schedule, unless objected to by the Architect or Owner, shall be used as a basis for reviewing the Contractor's Applications for Payment.

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

§ 5.1.6 Subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

.1 Take that portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the Contract Sum allocated to that portion of the Work in the schedule of values, less retainage of «ten » percent (« 10 » %). Pending final determination of cost to the Owner of changes in the Work, amounts not in dispute shall be included as provided in Section 7.3.9 of AIA Document A201™–2007, General Conditions of the Contract for Construction;

.2 Add that portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction (or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing), less retainage of « ten» percent (« 10 » %);

.3 Subtract the aggregate of previous payments made by the Owner; and

.4 Subtract amounts, if any, for which the Architect has withheld or nullified a Certificate for Payment as provided in Section 9.6 of AIA Document A201–2007, as amended.

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

.1 Add, upon Substantial Completion of the Work, a sum sufficient to increase the total payments to the full amount of the Contract Sum, less such amounts as the Architect shall determine for incomplete Work, retainage applicable to such work and unsettled claims; and

.2 Add, if final completion of the Work is thereafter materially delayed through no fault of the Contractor, any additional amounts payable in accordance with Section 9.10.3 of AIA Document A201–2007, as amended.

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

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

« None »

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§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 FINAL PAYMENT

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Section 12.2.2 of AIA Document A201–2007, and to satisfy other requirements, if any, which extend beyond final payment;

.2 the Contractor has submitted a final Application for Payment; and

.3 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:

§ 5.2.3 The Contract shall not have been fully performed until all work required by the Construction Documents including but not limited to the following have been performed:

.1 provision of record or as-built drawings executed or complete in both ".dwg" and ".pdf" formats;

.2 provision of executed or complete certificates of documents evidencing warranties and delivery owner-operators manuals;

.3 provision of all documents evidencing required testing, inspection, verification and other engineering or consulting services required under the construction contract;

.4 insuring agreements and bonds covering all periods of construction and any subsequent periods required under the contract;

.5 any necessary operational and maintenance instruction or demonstrations, and any service agreements.

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 INITIAL DECISION MAKER

The Architect will serve as Initial Decision Maker pursuant to Section 15.2 of AIA Document A201–2007, as amended, for Claims arising out of or relating to this Contract and asserted by Contractor against Owner.

§ 6.2 BINDING DISPUTE RESOLUTION

For any Claim subject to, but not resolved by, mediation pursuant to Section 15.3 of AIA Document A201–2007, the method of binding dispute resolution shall be as follows:

[« »] Arbitration pursuant to Section 15.4 of AIA Document A201–2007

[« X »] Litigation in a court of competent jurisdiction located in Cameron County, Texas.

[« »] Other *(Specify)*

« »

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 A201–2007, as amended.

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2007, as amended.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2007 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

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§ 8.2 Timeliness and interest due on payments to the Contractor are subject to and controlled by Texas Government Code Chapter 2251.

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

« Richard Molina »
«2021 Amistad Drive. »
« San Benito, Texas 78586 »

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

«

§ 8.5 The Contractor's representative may not be changed without written consent of the Owner, which shall not be unreasonably withheld.

§ 8.6 Terms in this Agreement shall have the same meaning as those in A201–2007.

§ 8.7 Governing Law
Section 13.1 of A201–2007 shall apply to this Agreement.

§8.8. Contractor hereby declares that it does not boycott Israel and will not boycott Israel during the term of this Agreement as described in Chapter 2270 of the Texas Government Code, as amended. Contractor further declares that it does not have a contract with or provide supplies or services to a foreign terrorist organization as defined in Chapter 2252 of the Texas Government Code, as amended.

§8.9. Prevailing Wage. Prevailing Wages must be paid to all laborers on the Project. Contractor shall provide and pay no less than the general prevailing rates for the Project location as determined in accordance with Applicable Laws, including Chapter 2258 of the Texas Government Code

§ 8.10 Owner's Occupancy Requirements
Owner will occupy portions of the premises during the entire construction period. Contractor shall cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Contractor shall perform the Work so as not to interfere with Owner's day-to-day operations. Contractor shall provide not less than 72 hours notice to Owner of activities that will affect Owner's operations.

Contractor is to coordinate its work with the Owner's occupied spaces to maintain access and existing exits for occupants. Contractor shall construct & maintain suitable barriers to permit the safe egress from the existing building during all phases of construction. Contractor is to limit and contain construction activities to minimize dust, disruption and safety hazards. Protection of occupants and operations is a primary concern.

Contractor is responsible for (1) progress cleaning of its own areas on a daily basis; (2) secure lockup of its own tools, materials, and equipment; (3) restoration of Owner's facilities used as temporary facilities or access to the site or temporary facilities; or any existing facilities damaged by Contractor; and (4) protection of existing Owner equipment that will remain in the work areas during construction. Setup, protection and cleanup will be required to be performed daily during the off peak hours so that the spaces will function as occupied spaces without obstruction during the day.

The Contractor shall take proper measures to protect all property within all construction areas, and adjacent or adjoining property which might be damaged by any process of construction; and, in case of any damage, Contractor shall restore at its own expense the damaged property to a condition equal to or better than that existing before such injury or damage was done, or Contractor shall make good such injury or damage in a manner acceptable to the

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Owner.

The Contractor shall protect the public and Owner fully by taking reasonable precaution to safeguard persons from death or bodily injury and to safeguard property of any nature whatsoever from damage. Where any dangerous condition or nuisance exists in and around construction sites, equipment and supply storage areas and other areas in any way connected with the performance of this Contract, the Contractor shall provide and maintain reasonable warning of such danger or nuisance. The Contractor shall not create excavation, obstructions, or any dangerous condition or nuisance of any nature whatsoever in connection with the performance of this Contract unless necessary to its performance, and in that event the Contractor shall provide and maintain at all times reasonable means of warning of any danger or nuisance created. The duties of the Contractor in this Paragraph shall be nondelegable, and the Contractor's compliance with the specific recommendations and requirements of the Owner, as to the means of warning shall not excuse the Contractor from the faithful performance of these duties should such recommendations and requirements not be adequate or reasonable under the circumstances.

§ 8.12 Change Order Markup

The Contractor shall not be entitled to any markup for profit/fee for Change Orders funded from amounts from the Betterment Fund (as defined in the Specifications). However, if the Betterment Fund is depleted Contractor's markup for home office and project overhead, general conditions costs (which include all costs for administration and supervision of the Work) profit/fee shall be calculated as follows:

For Contractor's "Self Perform Work" (labor performed by Contractor's employees, materials purchased directly by Contractor, and Contractor-owned or leased equipment used in the performance thereof):

Contractor's markup for home office and project overhead and its general conditions costs: ___% of the allowable labor, materials, and equipment costs with regard to the changed Work; and

Contractor's markup for profit/fee: 5% of the allowable labor, materials, and equipment costs with regard to the changed Work.

b. For Work performed by or through Contractor's subcontractors:

Contractor's markup for home office and project overhead and its general conditions costs: ___% of the allowable labor, materials, and equipment costs with regard to the changed Work; and

Contractor's markup for profit/fee: 5% of the allowable labor, materials, and equipment costs with regard to the changed Work.

Subcontractor markups for overhead, general conditions costs, and profit: 5% of the subcontractor's actual and direct cost to perform the Work.

If Work is performed by a sub-subcontractor, first tier subcontractor shall be entitled to the Contractor's markup for home office and project overhead and general conditions costs, but not a separate markup for profit/fee and sub-subcontractor shall be entitled to the subcontractor markup as provided above.

Notwithstanding the foregoing, for changes in the Work (such as an approved substitution or a change in a finish) that do not result in an increase in the Contract Time and that do not require the Contractor or a subcontractor to perform additional labor or incur additional costs for supervision and administration, no markup will be allowed for the Contractor (if applicable) and the respective subcontractor and the change in the Contract Sum shall be limited to the actual, direct change in the cost resulting from such approved change in the Work.

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

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

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§ 9.1.1 The Agreement is this executed AIA Document A101–2007, Standard Form of Agreement Between Owner and Contractor. The following Exhibits are attached hereto and incorporated fully herein.

Exhibit A - Insurance and Surety Requirements
Exhibit B – Schedule of Work
Exhibit C – List of Plans and Drawings
Exhibit D – Specifications
Exhibit E – TAC Title 28, Section 110.110

§ 9.1.2 The General Conditions are AIA Document A201–2007, General Conditions of the Contract for Construction, as modified.

§ 9.1.3 The Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages
« None »			

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

§ 9.1.5 The Drawings:
(Either list the Drawings here or refer to an exhibit attached to this Agreement.)
« See Exhibit C, List of Plans and Drawings. »

§ 9.1.6 The Addenda, if any:

Number	Date	Pages
« See Exhibit C, List of Plans and Drawings»		

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

ARTICLE 10 INSURANCE AND BONDS

The Contractor shall purchase and maintain insurance and provide bonds as set forth in Article 11 of AIA Document A201–2007.
(State bonding requirements, if any, and limits of liability for insurance required in Article 11 of AIA Document A201–2007.)

Type of insurance or bond	Limit of liability or bond amount ($0.00)
« See Exhibit A , Insurance and Surety Requirements »	

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

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« »	« »
OWNER (Signature)	*CONTRACTOR (Signature)*
« Richard Molina, Chief Appraiser»« »	« »«»
(Printed name and title)	*(Printed name and title)*

DRAFT

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EXHIBITS TO

AGREEMENT [AIA / A101 - 2007]

BETWEEN

CAMERON APPRAISAL DISTRICT (“OWNER”)

AND

[_____] (“CONTRACTOR”)

Cameron Appraisal District Offices Building Addition and Renovations Project

EXHIBIT A

INSURANCE REQUIREMENTS

Before commencing work, the Contractor (GC) shall, at its own expense, procure, pay for and maintain the following insurance written by companies approved by the state of Texas and acceptable to the Cameron Appraisal District. The GC shall furnish to the Cameron Appraisal District certificates of insurance executed by the insurer or its authorized agent stating coverages, limits, expiration dates and compliance with all applicable required provisions. Certificates shall reference the project and be addressed as follows:

REQUEST FOR COMPETITIVE SEALED PROPOSALS
FOR CONSTRUCTION SERVICES
FOR THE
THE CAMERON APPRAISAL DISTRICT OFFICES BUILDING ADDITION AND RENOVATIONS PROJECT
Cameron Appraisal District
2021 Amistad Drive, San Benito, Texas 78586

II. Builder's Risk Insurance

- Coverage shall be provided in an amount equal at all times to the full contract value, including change orders, and costs of debris removal for any single occurrence.
- Coverage shall be at least as broad as an unmodified ISO Special form, shall be provided on a completed-value basis, and shall be primary to any other insurance coverage available to the named insured parties, with that other insurance being excel, secondary and non-contributing.
- Coverage shall be specific as to coverage and not contributing insurance with any permanent insurance maintained on the Property.
- Loss, if any, shall be adjusted with and made payable to the Owner on behalf of all insureds as their interests may appear.
- The policy must provide coverage for:
    - Agreed Value Included
    - Damage arising from error, omission or deficiency in construction methods, design, sepecifications, workmanship or Included

materials, including collapse
    - Debris removal additional limit $1,000,000
    - Earthquake and Earthquake Sprinkler Leakage $5,000,000
    - Flood $5,000,000
    - Freezing Included
    - Mechanical breakdown including hot & cold testing Included
    - Ordinance or law $1,000,000
    - Pollutant clean-up and removal $25,000
    - Preservation of property Included
    - Theft Included
- Deductible shall not exceed
    - All Risks of Direct Damage, Per Occurrence, except $10,000
    - Named Storm 2% subject to $50,000 minimum
    - Earthquake and Earthquake Sprinkler Leakage, Per Occurrence $100,000
    - Flood, Per Occurrence or excess of NFIP if in Flood Zone A or V $100,000
- Insureds shall include Owner, General Contractor, all Loss Payees and Mortgagees, and subcontracts of all tiers in the Work as Insureds.
- Such insurance shall cover
    - All structure(s) under construction, including paved surfaces and roadways, glass, foundation(s), footings, underground pipes and wiring, excavations, grading, backfilling or filling;
    - All temporary structures (e.g., fencing, scaffolding, cribbing, false work, forms, site lighting, temporary utilities and buildings) located at the site;
    - All property including materials and supplies on site for installation;
    - All property including materials and supplies at other locations but intended for use at the site;
    - All property including materials and supplies in transit to the site for installation by all means of transportation other than ocean transit and
    - Other Work at the site identified in the Agreement to which this Exhibit is attached.
- No protective safeguard warranty shall be permitted
- The termination of coverage provision shall be endorsed to permit occupancy of the covered property being constructed. This insurance shall be maintained in effect, unless otherwise provided for the Agreement Documents, unil the earliest of:
    - The date on which all persons and organizations who are insureds under the policy agree that it shall be terminated;
    - Occupancy, in whole or in part;
    - The date on which release of substantial completion is executed; or
    - The date on which the unsurable interests of Contractor in the Covered Property has ceased.

II. CONTRACTOR FURNISHED LIABILITY INSURANCE

Contractor shall provide and maintain in effect at all times during the full term of its Work insurance coverages with Limits not less than those set forth below and subject to the conditions and requirements also set forth below. None of the requirements contained herein, including but not limited to requirements relating to types and limits of coverage, are intended to and shall not in any manner limit, qualify, or quantify the liabilities and obligations assumed by the Contractor under this Agreement or as otherwise provided by law. As used herein, the term "Agreement" shall refer to the AIA A101– 2007 / Owner – Contractor Agreement as modified by the parties and to which this Exhibit is attached and such relevant portions of the AIA A201 – 2007 as modified by the parties and incorporated into the Agreement.

A. Coverage Provided

1. **Commercial General Liability**. Contractor shall provide and maintain during the term of the Work and for a period of not less than five (5) years after completion of the entire Work of the Contract, including any warranty periods (or for such additional period as may be required herein) commercial general liability insurance covering Bodily Injury, Property Damage and Personal Injury on a coverage form at least as broad as the most recent edition of Commercial General Liability Coverage Form (CG 00 01) as published by the Insurance Services Office, Inc., covering losses that occur during the policy period regardless of when the claim is made, ***at limits of at least***:

$ 2,000,000 General Aggregate
$ 2,000,000 Products/Completed Operations Aggregate
$ 2,000,000 Personal Injury
$ 1,000,000 Each Occurrence – Property Damage / Bodily Injury

Without limiting the foregoing, coverage provided shall include the following:

a. Premises/operations,
b. Contractor's Protective for Contractor's liability arising out of the hire of Subcontractors (Independent Contractors),
c. Aggregate Limits of Insurance Per Project,
d. Contractual Liability specifically in support of, but not limited to, the indemnity provisions of the Contract Documents (including the "indemnity obligations arising under Section 3.18 of the General Conditions),
e. Personal Injury Liability,
f. Property Damage including Completed Operations,
g. Product/Completed Operations (for a period of **five years** following the Substantial Completion of the entire Work),

h. Explosion, collapse, and underground damage to property of others, (XCU) where such exposures exist,

i. Employees as Additional Insureds,

j Cross Liability Endorsement,

k. Waiver of Subrogation Endorsement, as required by contract, and

l. Thirty (30) days' notice of cancellation or non-renewal to Owner (using ISO Endorsement form CB 02 05 12 04 or equivalent).

The policy shall include endorsement ISO CG2503 (or equivalent) amendment of limits (designated project or premises), in order to extend the policy's limits specifically to the Project and to provide for Product/Completed Operations coverage for a period of not less than five (5) years after the Substantial Completion of the entire Work.

2. **Business Automobile Liability**. Contractor shall provide and maintain during the term of the Work, including any warranty periods, business automobile liability insurance on a standard form (approved by the Department of Insurance of the state in which the Project is located) written to cover all owned, hired and non-owned automobiles and motor vehicles, subject to the following ***minimum limits***:

$ 1,000,000 Combined Single Limit Each Accident

The Business Automobile Liability policy shall include an endorsement (form TE 0202A for Projects located in Texas or substantial equivalent for Projects located in other jurisdictions) providing thirty (30) days' notice of cancellation to Owner.

3. **Workers' Compensation/Employers' Liability**. Contractor shall provide and maintain during the term of the Work, including any warranty periods, statutory Workers' Compensation Insurance Coverage [as defined in Sec. 402.011(44) of the Texas Labor Code for Projects located in the State of Texas] for all of Contractor's workers at the site of the Project. In case any work is sublet, the Contractor shall require all subcontractors similarly to provide Workers' Compensation insurance for all the latters' employees unless such employees are covered by the protection afforded by the Contractor, or, when applicable, Contractor has complied with the requirements for joint agreements with independent contractors under Applicable Law [see Sections 406.141 - 406.145, Texas Labor Code for Projects located in the State of Texas]. U.S.L. and H. shall be provided where such exposure exists. No "alternative" form of coverage will be accepted under any condition ("Occupational Accident and Excess Employers Indemnity Policies" are not acceptable.)

Additionally, Contractor shall maintain during the term of the Work Employers' Liability Coverage with limits of $1,000,000 Bodily Injury per Accident/Employee; $1,000,000 Bodily Injury Per Disease/Employee; and $1,000,000 Policy limit by disease.

The Workers' Compensation and Employers Liability policies shall include an endorsement (form

WC 420601 for Projects located in Texas or substantial equivalent for Projects located in other jurisdictions) providing thirty (30) days' notice of cancellation / material change to Owner.

NOTE: waiver of subrogation requirement in Section 7 of the "Other Terms and Conditions" below.

4. **Umbrella / Excess Liability Insurance**. Contractor shall provide and maintain during the term of the Work, including any warranty periods, umbrella excess liability insurance coverage on a policy form acceptable to Owner, providing coverage in excess of the limits specified above for CGL, Business Automobile Liability, and Employers Liability. Such policy shall have the same inception and expiration dates as the underlying liability policies and coverage no less broad than those in the primary policies or program (shall include "Following Form" language to the primary policy). Minimum limits shall be:

$ 8,000,000	Each Occurrence
$ 8,000,000	Completed Operations Aggregate
$ 8,000,000	Annual Aggregate

Without limiting the foregoing, such umbrella / excess coverage shall "follow form" with regard to the primary coverage (*i.e.*, shall provide coverage) to the extent such primary coverage's limits are dedicated to the Project and such primary coverage provides for an extended period for Products / Completed Operations coverage.

B. Other Terms and Conditions

1. Subcontractors Insurance. Except with Owner's written approval, insurance similar to that required of Contractor, other than the Umbrella Liability Insurance and Professional Liability Insurance (except as required below), shall be furnished by all subcontractor(s) to cover their operation performed under any Agreement; provided, however, that the minimum limit by subcontractors for General Aggregate under their Comprehensive General Liability shall be $500,000 on minor subcontracts and $1,000,000 on major subcontracts and Owner shall waive any Additional Insured endorsement requirement to the extent that the Contractor waives its requirement, if any, as an Additional Insured with regard to the respective subcontractor's liability coverage. Contractor shall maintain Certificates of Insurance from all subcontractors, enumerating, among other things, the Waivers in favor of, the Owner, as required herein, and make them available to the Owner upon request. The term "subcontractor(s)" shall include subcontractor of any tier.

Each Subcontractor required to furnish professional design services within that Subcontractor's respective scope of Work shall furnish and maintain Professional Liability Insurance substantially similar to that required of the Contractor.

2. Insurer Requirements, Rating and Forms. Contractor's insurance coverage must be written with insurance companies licensed and admitted by the Department of Insurance of the state in which the Project is located to provide such insurance coverage in such state and must be written under either the respective Department of Insurance's standard forms or forms of policies satisfactory to Owner. All such insurers must be reasonably acceptable to Owner and, other than the insurer(s) providing the Workers' Compensation Insurance Coverage, rated no less than A- VII as shown in the most current issue of A.M. Best's Key Rating Guide.

3. Occurrence Basis. All such policies other than Professional Liability shall be written on an Occurrence (not Claims made) basis.

4. Deductibles and Self-Insured Retentions. All deductibles and self-insured retention amounts (except as expressly set forth herein or in any of the Contract Documents) must be acceptable to the Owner. Any and all deductibles in the above-described liability insurance policies shall be assumed by, for the account of, and at the sole risk of the Contractor.

5. Additional Insured. The Commercial General Liability, the Umbrella / Excess Liability, the Contractor's Pollution Liability, and the Business Automobile Liability policies each must name the Owner and the other Indemnified Parties identified in the Agreement or Section 3.18 of the General Conditions, as Additional Insureds, using an endorsement form at least as broad as the ISO Additional Insured Endorsement Form CG 2010 11 85 or ISO Additional Insured Endorsement CG 2010 10 01 if used with ISO Form 2037 1001 (or their combined equivalent). It is the intent of the parties to this Contract that this Additional Insured status shall include, without limitation, coverage for completed operations and for the Owner's negligence (but only to the extent allowed by Applicable Law, including Chapter 151, Texas Insurance Code, for Projects located in Texas).

6. Primary / Non-Contributing Liability. All liability policies required to be furnished and maintained by Contractor shall be primary insurance to any other insurance that may be available to Owner and the other Indemnified Parties identified in the Agreement or Section 3.18 of the General Conditions. It is the intent of the parties to this Contract that all insurance coverage required herein shall be primary to and shall seek no contribution from all insurance available to Owner and such other Indemnified Parties, with Owner's and such other Indemnified Parties' insurance being excess, secondary, and non-contributing.

7. Waivers of Subrogation. Waivers of Subrogation shall be provided in favor of the Owner and the other Indemnified Parties identified in the Agreement or Section 3.18 of the General Conditions with regard to Commercial General Liability, the Umbrella / Excess Liability, the Contractor's Pollution Liability, Business Automobile Liability, and Workers' Compensation/Employers policies required to be furnished and maintained by Contractor.

Without limiting the foregoing,

a. the Workers' Compensation and Employers Liability policies shall include an endorsement (form WC 420304) waiving subrogation in favor of the Owner and the Real Property Owner,

b, the Commercial General Liability policy shall include an endorsement (ISO form CG 2404) waiving subrogation in favor of the Owner and the Real Property Owner, and

c. the Business Automobile Liability policy shall include an endorsement (form TE 2046A) waiving subrogation in favor of the Owner and the Real Property Owner.

8. Evidence of Insurance. Before commencing performance of the Work, the Contractor (and those subcontractors requested by Owner) must furnish to Owner certificates of insurance for the coverage required hereunder (on ACORD form 28 for Builders Risk insurance, if provided by Contractor, and on ACORD form 25 for liability insurance) or, if requested by Owner, copies of such insurance policies evidencing the terms and conditions required hereunder.

New certificates of Insurance shall be provided to Owner prior to the current certificate(s) coverage termination date if prior to completion of the Work. Lapsed coverage of insurance required by the Agreement is an act of default under the Agreement. Proof of insurance required hereunder must clearly set forth:

a. Insurance coverage as required herein (including all endorsements providing coverage).

b. The effective expiration dates of policies.

c. 30 days' prior written notice to the Owner of cancellation or non-renewal of policy.

d. A waiver of subrogation endorsement in the policies as required herein.

e. Any deductible and/or self-insured retention.

f. Any exclusions to the policy (clearly identifying any endorsements excluding coverages) which are not part of the required standard form of policy.

g. Owner and the other Indemnified Parties named as Additional Insureds on all liability policies required hereunder by Owner.

Upon Owner's request, Contractor shall provide Owner a certified copy of the Contractor's actual insurance policy thereof, along with endorsements.

9. Notice of Cancellation. With regard to all coverages Contractor is required to maintain hereunder, Contractor shall be obligated to notify the Owner in writing no later than thirty (30) days prior to the cancellation of or any reduction or any other material change in coverage or intent not to renew coverage.

10. Additional Required Insurance. Owner may elect at any time during the term of this Agreement to require Contractor to procure and maintain other or additional insurance. Notice of such election shall be given at least sixty (60) days prior to the effective date of the required modifications. Any additional costs incurred by these parties in securing insurance shall be reimbursed by Owner as a part of the Cost of the Work, and the Contract Price shall be revised by Change Orders to be increased by the amount of such additional reimbursement.

11. Contractor Obligations. Contractor shall not violate or knowingly permit to be violated by

itself or any of its subcontractors any conditions of the policy of insurance provided by Contractor under the terms of this Agreement and shall at all times satisfy the requirements of the insurance companies issuing them. All requirements imposed by the policies referred to above, and to be performed by Contractor shall likewise be imposed upon, assumed and performed by each of the subcontractors. Contractor and each subcontractor shall execute with their subcontractors a written agreement, which shall include all such requirements.

12. Coverages. The coverages referred to above are set forth in full in the respective policy forms, and the foregoing description of such policies are not intended to be complete, or to alter or amend any provisions of the actual policies and in matters, if any, in which the said description may be conflicting with such instruments, the provision of the actual policies of insurance shall govern.

13. No Limitation on Liability. The amount and types of insurance coverage required to be provided by Contractor herein, including any limitation on Contractor's obligation to include Owner and related parties as Additional Insureds on Contractor's liability policies, shall not be construed to be a limitation of the liability on the part of the Contractor or any of its Subcontractors.

14. **TAC Provisions.** The Contractor agrees to comply with all applicable provisions of Texas Administrative Code Title 28, Section 110.110, building or construction contracts with governmental entities, a copy of which is attached to the Construction Agreement as **Exhibit E**, and the contractual requirements of which are incorporated by reference in this Construction Agreement. Under Section 110.110:

1.) Certain language must be included in this Construction Agreement and in theContractor’s contracts with sub-contractors and others relating to the work;

2.) The Contractor is required to submit to the City certificates of coverage for its employees and for all others providing services relating to the work until all project work is completed; and

3.) The Contractor is required to post certain notices at job sites.

2.15 Bonding Requirements:

A. Contractors shall furnish Payment and Performance Bonds in accordance with Section 2253.021 of the Texas Government Code.

B. Payment and Performance Bond: Contractor shall furnish Bonds in favor of the Owner in an amount equal to 100% of the total construction cost under this Contract. Total construction cost are defined as the entire cost of materials and their installation, and include, but are not limited to, the cost of labor, equipment, supplies, materials and additional construction costs. The bond shall have corporate Sureties that are licensed to conduct business in Texas and are A.M. Best Rated "B+" or better. If the surety on any bond furnished by the Contractor to the Owner is declared bankrupt or becomes insolvent, or has its right to do business revoked in the State of Texas, then the Contractor will have ten (10) days to substitute another bond and surety therefore which shall be acceptable to Owner and which shall be at the expense of the Contractor.

EXHIBIT B

SCHEDULE OF WORK

[See Attached]

EXHIBIT C

LIST OF PLANS AND DRAWINGS

EXHIBIT D

LIST OF SPECIFICATIONS

EXHIBIT E

TAC TITLE 28, SECTION 110.110

(a) The following words and terms, when used in this rule, shall have the following meanings, unless the context clearly indicates otherwise. Terms not defined in this rule shall have the meaning defined in the Texas Labor Code, if so defined.

(1) Certificate of coverage (certificate)--A copy of a certificate of insurance, a certificate of authority to self-insure issued by the division, or a workers' compensation coverage agreement (DWC Form-81, DWC Form-82, DWC Form-83, or DWC Form-84), showing statutory workers' compensation insurance coverage for the person's or entity's employees (including those subject to a coverage agreement) providing services on a project, for the duration of the project.

(2) Building or construction--Has the meaning defined in the Texas Labor Code, §406.096(e)(1).

(3) Contractor--A person bidding for or awarded a building or construction project by a governmental entity.

(4) Coverage--Workers' compensation insurance meeting the statutory requirements of the Texas Labor Code, §401.011(44).

(5) Coverage agreement--A written agreement on DWC Form-81, DWC Form-82, DWC Form-83, or DWC Form-84, filed with the Division of Workers' Compensation which establishes a relationship between the parties for purposes of the Texas Workers' Compensation Act, pursuant to the Texas Labor Code, Chapter 406, Subchapters F and G, as one of employer/employee and establishes who will be responsible for providing workers' compensation coverage for persons providing services on the project.

(6) Duration of the project--Includes the time from the beginning of work on the project until the work on the project has been completed and accepted by the governmental entity.

(7) Persons providing services on the project ("subcontractor" in §406.096 of the Act)--With the exception of persons excluded under subsections (h) and (i) of this section, includes all persons or entities performing all or part of the services the contractor has undertaken to perform on the project, regardless of whether that person contracted directly with the contractor and regardless of whether that person has employees. This includes but is not limited to independent contractors, subcontractors, leasing companies, motor carriers, owner-operators, employees of any such entity, or employees of any entity furnishing persons to perform services on the project. "Services" includes but is not limited to providing, hauling, or delivering equipment or materials, or providing labor, transportation, or other service related to a project. "Services" does not include activities unrelated to the project, such as food/beverage vendors, office supply deliveries, and delivery of portable toilets.

(8) Project--Includes the provision of all services related to a building or construction contract for a governmental entity.

(b) Providing or causing to be provided a certificate of coverage pursuant to this rule is a representation by the insured that all employees of the insured who are providing services on the

project are covered by workers' compensation coverage, that the coverage is based on proper reporting of classification codes and payroll amounts, and that all coverage agreements have been filed with the appropriate insurance carrier or, in the case of a self-insured, with the division. Providing false or misleading certificates of coverage, or failing to provide or maintain required coverage, or failing to report any change that materially affects the provision of coverage may subject the contractor or other person providing services on the project to administrative penalties, criminal penalties, civil penalties, or other civil actions.

(c) A governmental entity that enters into a building or construction contract on a project shall:

(1) include in the bid specifications, all the provisions of paragraph (7) of this subsection, using the language required by paragraph (7) of this subsection;

(2) as part of the contract, using the language required by paragraph (7) of this subsection, require the contractor to perform as required in subsection (d) of this section;

(3) obtain from the contractor a certificate of coverage for each person providing services on the project, prior to that person beginning work on the project;

(4) obtain from the contractor a new certificate of coverage showing extension of coverage:

(A) before the end of the current coverage period, if the contractor's current certificate of coverage shows that the coverage period ends during the duration of the project; and

(B) no later than seven days after the expiration of the coverage for each other person providing services on the project whose current certificate shows that the coverage period ends during the duration of the project;

(5) retain certificates of coverage on file for the duration of the project and for three years thereafter;

(6) provide a copy of the certificates of coverage to the division upon request and to any person entitled to them by law; and

(7) use the language contained in the following figure for bid specifications and contracts, without any additional words or changes, except those required to accommodate the specific document in which they are contained or to impose stricter standards of documentation:

Attached Graphic

(d) A contractor shall:

(1) provide coverage for its employees providing services on a project, for the duration of the project based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements;

(2) provide a certificate of coverage showing workers' compensation coverage to the governmental entity prior to beginning work on the project;

(3) provide the governmental entity, prior to the end of the coverage period, a new certificate of coverage showing extension of coverage, if the coverage period shown on the contractor's current certificate of coverage ends during the duration of the project;

(4) obtain from each person providing services on a project, and provide to the governmental entity:

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

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

(5) retain all required certificates of coverage on file for the duration of the project and for one year thereafter;

(6) notify the governmental entity in writing by certified mail or personal delivery, within ten days after the contractor knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project;

(7) post a notice on each project site informing all persons providing services on the project that they are required to be covered, and stating how a person may verify current coverage and report failure to provide coverage. This notice does not satisfy other posting requirements imposed by the Act or other division rules. This notice must be printed with a title in at least 30 point bold type and text in at least 19 point normal type, and shall be in both English and Spanish and any other language common to the worker population. The text for the notices shall be the following text provided by the division on the sample notice, without any additional words or changes:

Attached Graphic

(8) contractually require each person with whom it contracts to provide services on a project to:

(A) provide coverage based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements for all of its employees providing services on the project, for the duration of the project;

(B) provide a certificate of coverage to the contractor prior to that person beginning work on the project;

(C) include in all contracts to provide services on the project the language in subsection (e)(3) of this section;

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

(E) obtain from each other person with whom it contracts, and provide to the contractor:

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

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

(F) retain all required certificates of coverage on file for the duration of the project and for one year thereafter;

(G) notify the governmental entity in writing by certified mail or personal delivery, within ten days after the person knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project; and

(H) contractually require each other person with whom it contracts, to perform as required by subparagraphs (A) - (H) of this paragraph, with the certificate of coverage to be provided to the person for whom they are providing services.

(e) A person providing services on a project, other than a contractor, shall:

(1) provide coverage for its employees providing services on a project, for the duration of the project based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements;

(2) provide a certificate of coverage as required by its contract to provide services on the project, prior to beginning work on the project;

(3) have the following language in its contract to provide services on the project: "By signing this contract or providing or causing to be provided a certificate of coverage, the person signing this contract is representing to the governmental entity that all employees of the person signing this contract who will provide services on the project will be covered by workers' compensation coverage for the duration of the project, that the coverage will be based on proper reporting of classification codes and payroll amounts, and that all coverage agreements will be filed with the appropriate insurance carrier or, in the case of a self-insured, with the division. Providing false or misleading information may subject the contractor to administrative penalties, criminal penalties, civil penalties, or other civil actions."

(4) provide the person for whom it is providing services on the project, prior to the end of the coverage period shown on its current certificate of coverage, a new certificate showing extension of coverage, if the coverage period shown on the certificate of coverage ends during the duration of the project;

(5) obtain from each person providing services on a project under contract to it, and provide as required by its contract:

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

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

(6) retain all required certificates of coverage on file for the duration of the project and for one year thereafter;

(7) notify the governmental entity in writing by certified mail or personal delivery, of any change that materially affects the provision of coverage of any person providing services on the project and send the notice within ten days after the person knew or should have known of the change; and

(8) contractually require each other person with whom it contracts to:

(A) provide coverage based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements for all of its employees providing services on the project, for the duration of the project;

(B) provide a certificate of coverage to it prior to that other person beginning work on the project;

(C) include in all contracts to provide services on the project the language in paragraph (3) of this subsection;

(D) provide, prior to the end of the coverage period, a new certificate of coverage showing extension of the coverage period, if the coverage period shown on the current certificate of coverage ends during the duration of the project;

(E) obtain from each other person under contract to it to provide services on the project, and provide as required by its contract:

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

(ii) prior to the end of the coverage period, a new certificate of coverage showing extension of the coverage period, if the coverage period shown on the current certificate of coverage ends during the duration of the contract;

(F) retain all required certificates of coverage on file for the duration of the project and for one year thereafter;

(G) notify the governmental entity in writing by certified mail or personal delivery, within ten days after the person knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project; and

(H) contractually require each person with whom it contracts, to perform as required by this subparagraph and subparagraphs (A) - (G) of this paragraph, with the certificate of coverage to be provided to the person for whom they are providing services.

(f) If any provision of this rule or its application to any person or circumstance is held invalid, the invalidity does not affect other provisions or applications of this rule that can be given effect without the invalid provision or application, and to this end the provisions of this rule are declared to be severable.

(g) This rule is applicable for building or construction contracts advertised for bid by a governmental entity on or after September 1, 1994. This rule is also applicable for those building or construction contracts entered into on or after September 1, 1994, which are not required by law to be advertised for bid.

(h) The coverage requirement in this rule does not apply to motor carriers who are required pursuant to Texas Civil Statutes, Article 6675c, to register with the Texas Department of Transportation and who provide accidental insurance coverage pursuant to Texas Civil Statutes, Article 6675c, §4(j).

(i) The coverage requirement in this rule does not apply to sole proprietors, partners, and corporate officers who meet the requirements of the Act, §406.097(c), and who are explicitly excluded from coverage in accordance with the Act, §406.097(a) (as added by House Bill 1089, 74th Legislature, 1995, §1.20). This subsection applies only to sole proprietors, partners, and corporate executive

officers who are excluded from coverage in an insurance policy or certificate of authority to self-insure that is delivered, issued for delivery, or renewed on or after January 1, 1996.

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AIA® Document A201™ – 2007

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)
Cameron Appraisal District Offices
Building Addition and Renovations Project »
«2021 Amistad Drive »
San Benito, Texas 78586

THE OWNER:
(Name, legal status and address)
Cameron Appraisal District»« »
« 2021 Amistad Drive»
« San Benito, Texas 78586

THE ARCHITECT:
(Name, legal status and address)
K+ Architect, Inc.
400 East Third Street
Los Fresnos, Texas 78566»
« Attn: Stanford Knowles»
« 956.233.2218

TABLE OF ARTICLES

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10 PROTECTION OF PERSONS AND PROPERTY

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12 UNCOVERING AND CORRECTION OF WORK

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

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

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13 MISCELLANEOUS PROVISIONS

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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 Standard Form of Agreement Between Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract, performance and payment bonds, 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 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 and certify termination of the Agreement under Section 14.2.2. However, in no event shall the Initial Decision Maker provide legal advice to either party in connection with this obligation.

§ 1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

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

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

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

§ **1.2.4** In the event of a conflict between the provisions of any of The Contract Documents, the terms shall be interpreted in the following order of controlling authority:

1. The Agreement,
2. Special Conditions
3. General Conditions
4. Specifications & Drawings

Should the Specifications and Drawings conflict, proposals shall be based on the most expensive combination of quality and quantity of Work indicated. Any Conflicts not resolved by a quality and quantity determination, or conflicts involving priority of controlling authority of the Contract Documents shall be determined by the Initial Decision Maker.

§ 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 Contractor, Subcontractors, Sub-subcontractors, and material or equipment 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 this Project is not to be construed as publication in derogation of Owner's reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are authorized to use and reproduce the Instruments of Service provided to them 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 material or equipment suppliers may not use the Instruments of Service on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect and the Architect's consultants.

§ 1.6 TRANSMISSION OF DATA IN DIGITAL FORM

If the parties intend to transmit Instruments of Service or any other information or documentation in digital form, they shall endeavor to establish necessary protocols governing such transmissions, unless otherwise already provided in the Agreement or the Contract Documents.

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 authority granted to the Architect in section 4.2.1 is limited to contract administration and does not convey any authority on the Architect to bind the Owner to any agreements, actions, inactions, or otherwise. The term "Owner" means the Owner or the Owner's authorized representative.

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§ 2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

§ 2.2.1 Prior to commencement of the Work, the Contractor may request in writing that the Owner provide reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract.

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

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

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

§ 2.2.5 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.

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

§ 2.4 OWNER'S RIGHT TO CARRY OUT THE WORK

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 written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the 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 payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

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 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. The Contractor waives any rights, claims, or causes of action against Owner and/or Architect ~~or Architect~~ as a result of activities or duties of the Architect in the Architect's administration of the Contract or representations made by the Architect in the Instruments of Service.

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§ 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 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 2.2.3, 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 shall take field measurements and verify field conditions, and must carefully compare such field measurements and conditions and other information known to the Contractor with the Contract Documents, before ordering any material or performing any Work. Any field notes taken by Contractor in performing measurements and verifications must be provided to Owner and Architect.

§ 3.2.4 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.

§ 3.2.5 If the Contractor believes that any portions of the Contract Documents do not comply with applicable laws, statutes, ordinances, building codes, and rules and regulations, or any orders by code enforcement officials or the Owner or its designees acting in the capacity of building code inspectors or Referenced Standards, the Contractor must promptly notify the Owner and the Architect of the non-compliance as provided in Section 3.2.7 and request direction before proceeding with the affected Work.

§ 3.2.6 If the Contractor performs any Work involving an apparent error, inconsistency, ambiguity, construction impracticality, omission or code violation in the Contract Documents of which the Contractor is aware, or which could reasonably have been discovered by the review required by Sections 3.2.1 through 3.2.5, without prompt written notice to the Owner and the Architect and request for correction, clarification or additional information, as appropriate, the Contractor does so at its own risk and expense and all claims relating thereafter are specifically waived against Owner, any of the Owner's separate contractors, Architect, and Architect's consultants of any tier. ~~.~~

§ 3.2.7 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, through 3.2.6, the Contractor shall make Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, through 3.2.6, the Contractor shall pay such costs and damages to the Owner 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.

§ 3.2.8 Contractor, for itself and its subcontractors, acknowledges that the construction premises are restricted and that access is affected by the security at the project, location of the Project, by the Facilities surrounding the Project and by other construction either presently being performed or proposed to be performed during the performance of this Contract. Contractor, for itself and its subcontractors, further acknowledges that such limitations in space and accessibility have been taken into account in the Contract Price.

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§ 3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner and Architect and shall not proceed with that portion of the Work without further written instructions from the Architect. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures.

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

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

§ 3.4 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 authorized by the Architect in accordance with Sections 3.12.8 or 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.

§ 3.4.3 For any such substitutions, the Contractor warrants that modifications suggested by the Contractor will give satisfactory results.

§ 3.4.4 For any such substitutions, the Contractor warrants that substitutions will be equal or superior to the specified item or method unless the Contractor specifically lists shortcomings in its request for making substitution.

§ 3.4.5 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 Owner or Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment. The warranties set out in this subsection are not exclusive of any other warranties or guarantees set out in other places in the Contract Documents or implied under applicable law.

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§ 3.5.2 The Contractor agrees to assign to the Owner at the time of final completion of the Work, any and all manufacturer's warranties relating to materials and labor used in the Work and further agrees to perform the Work in such manner so as to preserve any and all such manufacturer's warranties.

§ 3.5.3 If extended warranties in addition to those required by the Contract Documents are available from Subcontractors, Sub-subcontractors, manufacturers or suppliers, Contractor shall advise Architect and Owner of such availability and the cost thereof and, if requested by Change Order, shall purchase the extended warranty for Owner's benefit, in which event the Change Order shall reflect an increase in the Contract Sum equal to the cost of the extended warranty submitted to and accepted by Owner.

§ 3.5.4 All guarantees and warranties of materials and services furnished to Contractor or Subcontractors by any Subcontractor, Sub-subcontractor, manufacturer or supplier shall be deemed to run for the benefit of the Owner. Contractor hereby assigns to Owner the benefits of all guarantees and warranties of all Subcontractors, Sub-subcontractors, manufacturers and suppliers engaged for the Project, but such assignment shall not relieve Contractor of its warranty obligations to Owner under the Contract Documents or Applicable Laws.

§ 3.6 TAXES

§ 3.6.1 The Owner enjoys tax exempt status as a municipality. To enjoy the cost-savings benefits of its tax-exempt status, the Owner will provide a Tax Exemption Certificate to the Contractor for use on the Project. The Contractor shall use that certificate to exempt any purchases made for the Work from taxes. All savings for the tax-exempt status will be passed on to the Owner by the Contractor. The Contractor agrees to bind all Subcontractors of any tier to the obligation to present and use the Tax Exemption Certificate and pass all savings to the Owner.

§3.6.2 The Contractor will require all Subcontractors and bidders to provide cost information for materials separate from other costs for labor, profit, overhead, etc. to allow the Owner to verify that no taxes are to be paid on material procurement and that such savings shall be passed on to the Owner.

§3.6.3 The Contractor will maintain all records, invoices, receipts, or other accounting data regarding material purchases and will allow, upon written request of the Owner and within a reasonable time frame after receipt of such request, the Owner to audit such records to verify tax savings. If an audit reveals taxes paid or savings not transferred to the Owner, the Contractor will be liable to the Owner for those amounts and the Owner may back-charge the Contractor for those amounts if a balance of funds due and payable remains at the time of such discovery.

.1 The Contractor will require all Subcontractors of any tier maintain all records, invoices, receipts, or other accounting data regarding material purchases. The Contractor will collect such records with each application for payment it receives from its Subcontractors and shall maintain such records in the same manner and location as the Contractor's records.

.2 The Contractor will ensure its Subcontractors and any lower-tier Subcontractors include these obligations in their contracts and bind themselves in the same manner as Contractor is bound to the Owner.

§ 3.6.4 Subject to the terms above, 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.

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§ 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 21 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 an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor in writing, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may proceed 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, 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 furnish in writing to the Owner through the Architect the name and qualifications of a proposed superintendent. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to the proposed superintendent or (2) that the Architect requires additional time to review. Failure of the Architect to reply within the 14 day period shall constitute notice of no reasonable objection.

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§ 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 SCHEDULES

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work. Thereafter, the Contractor shall prepare and update the construction schedule on a monthly basis, if not more frequently at the Contractor's discretion, to be submitted to the Owner with each Application for Payment.

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

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

§ 3.11 DOCUMENTS AND SAMPLES AT THE SITE

The Contractor shall maintain at the site for the Owner one copy of the Drawings, Specifications, Addenda, Current Construction Schedule, Change Orders and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and one copy of approved Shop Drawings, Product Data, Samples and similar required submittals. The Contractor shall display a Current Construction Schedule at the site for reference and reliance by the Owner and Architect. These shall be available to the Architect and shall be delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

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

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

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

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

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

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§ 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. Should the Contractor perform portions of the Work in contravention of this section, any costs and time associated with the correction, removal, or repair of said Work shall be borne solely by the Contractor.

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

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

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

§ 3.13 USE OF SITE

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

§ 3.14 CUTTING AND PATCHING

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

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by

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excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

§ 3.15 CLEANING UP

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

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

§ 3.16 ACCESS TO WORK

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

§ 3.17 ROYALTIES, PATENTS AND COPYRIGHTS

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

§ 3.18 INDEMNIFICATION

§ 3.18.1 TO THE FULLEST EXTENT PERMITTED BY LAW THE CONTRACTOR SHALL DEFEND INDEMNIFY AND HOLD HARMLESS THE OWNER, OWNER'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, BUT ONLY IF CAUSED, IN WHOLE OR IN PART, 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. 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.

§ 3.18.3 It is agreed with respect to any legal limitations now or hereafter in effect and affecting the validity or enforceability of the indemnification obligations under this Section 3.18 or the Additional Insured requirements of **Exhibit A**, such legal limitations are made a part of the contractual obligations and shall operate to amend the obligations to the minimum extent necessary to bring the provision into conformity with the requirements of such limitations, and as so modified, the obligations shall continue in full force and effect. Should any provision in this Agreement be held invalid, unenforceable or contrary to public policy, law, statute or ordinance, then the remainder

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of the provision, paragraph, Section and/or Agreement shall not be affected thereby and shall remain valid and fully enforceable.

§ 3.18.4 The obligations contained in this Section 3.18 shall survive the expiration, completion, abandonment and/or termination of the Agreement and final completion of the Work and any other services to be provided pursuant to this Agreement but in no event shall survive beyond the term of the applicable Statute of Repose.

ARTICLE 4 ARCHITECT

§ 4.1 GENERAL

§ 4.1.1 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.

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

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

§ 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, except as provided in Section 3.3.1. The Architect's or Architect's representative's presence at the Project site shall not imply concurrence with or approval of the Work. The Contractor shall call specific items to the Architect's attention in writing if it wishes to obtain the Architect's opinion.

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

§ 4.2.4 COMMUNICATIONS FACILITATING CONTRACT ADMINISTRATION

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

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

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§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review 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, unless otherwise specifically stated by the Architect, of any construction means, methods, techniques, sequences or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

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

§ 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 duties, responsibilities and limitations of authority of such project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents.

§ 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.

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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 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 or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to any such proposed person or entity or (2) that the Architect requires additional time for review. Failure of the Owner or Architect to reply within the 14-day period shall constitute notice of no reasonable objection.

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

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

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

§ 5.3 SUBCONTRACTUAL RELATIONS

By appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, which the Contractor, by these Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. 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

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.1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor in writing; and

.2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

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 such assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

§ 6.1.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Article 15.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each separate contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to the construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, separate contractors and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces, the Owner shall be deemed to be subject to the same obligations and to have the same rights that apply to the Contractor under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6 and Articles 10, 11 and 12.

§ 6.2 MUTUAL RESPONSIBILITY

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

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

§ 6.2.3 The 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.

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§ 6.2.4 The Contractor shall promptly remedy damage the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or separate contractors 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, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or order for a minor change in the Work.

§ 7.1.4 No Work, or portion of the Work, performed by the Contractor in excess or deviation from the Contract Documents will be subject to adjustments in the Contract Sum or Contract Time without prior written authorization as provided in this Article.

§ 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; in accordance with Contract Documents; 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 7.3.7.

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

§ 7.3.5 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.

§ 7.3.6 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.

§ 7.3.7 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Owner or Architect shall determine the method and the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. Contract Documents. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.7 shall be limited to the following:

.1 Costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;

.2 Costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;

.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;

.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work; and

.5 Additional costs of supervision and field office personnel directly attributable to the change.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect and overhead on such deleted work. 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 has authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes will be effected by written order signed by the Architect and shall be binding on the Owner and Contractor.

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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 In all aspects of the Work and other obligations owed by the Contractor to the Owner under the Contract Documents, the time limits stated in the Contract Documents are of the essence of the Contract. Failure to adhere to the time limits contained in the Contract Documents is a material breach of the Agreement. By executing the Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§8.2.4 Should the Contractor default on its obligations to make progress and complete the Work on time, as allowed in the Contract Documents, the Owner may withhold or deduct all costs and damages for compensable delay caused by the Contractor from the Contract Sum. Such costs shall include any attorney's fees, additional services fees charged by the Architect in addition to the Architect's Basic Services, and all other costs, expenses, and damages actually incurred by the Owner as a result of such delay.

§ 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) changes in the Applicable Law made after the effective date of the Contract; or by labor disputes (not arising from the labor practices of Contractor or its Subcontractors, Suppliers, or Sub-subcontractors), fire (not caused by Contractor or its Subcontractors, Suppliers, or Sub-subcontractors), unusual delay in deliveries (not attributable to or caused by Contractor or its Subcontractors, Suppliers, or Sub-subcontractors), adverse weather abnormal for the period of time (as defined in Section 4.5 of the Agreement) and in excess of any weather days required by the Contract Documents to be included in the Schedule of the Work or otherwise allotted in the Contractor's Progress Schedule, or unavoidable casualties beyond the control and reasonable ability to avoid by the Contractor or its Subcontractors, Suppliers, or Sub-subcontractors (such causes are collectively referred to in the Contract Documents as causes "Excusable Delay"), (2) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; or (3) by changes ordered in the Work (not caused or resulting from the failure of Contractor or its Subcontractors, Suppliers, or Sub-subcontractors to comply with their obligations arising under the Contract); then the Contract Time shall be extended by Change Order by the number of days by which the critical path to completion of the Project has been delayed by the event giving rise to the right to an extension. Notwithstanding the foregoing, the Contractor acknowledges and agrees that adjustments in the Contract Time will be permitted for a delay only to the extent such delay: (1) is not caused or could not have been reasonably anticipated and mitigated by the Contractor; (2) could not be limited or avoided by the Contractor's timely notice to the Owner of the delay; and (3) is in addition to any time contingency periods set forth in the critical path for completion of the Work.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 To the fullest extent permitted under applicable law, **extensions of time** shall be the Contractor's **sole remedy** for delay, including any Excusable Delay, unless the delay is caused by the Owner's intentional interference, fraud, or misrepresentation. In the event of any delay entitling Contractor to an increase in Contract Sum, Contractor's

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recovery shall be limited to the increase, if any, of direct costs incurred by the Contractor in performing the Work as a result of that portion of delay or delays which cause the Contract Time to be extended. Direct costs do not include overhead, profit, or any consequential damages, lost opportunity costs, impact damages, or other similar remuneration. The Owner's reasonable exercise of any of its rights or remedies under the Contract Documents, regardless of the extent or frequency, shall not under any circumstances be construed as interference with the Contractor's performance of the Work. In no event shall the Contractor be entitled to any other compensation or recovery of any damages in connection with any Excusable Delay. Nothing contained herein shall prohibit recovery by Owner of liquidated damages for Contractor's delay pursuant to the Agreement. Contractor shall not be compensated nor given extensions of time for delays that are unexcused.

§ 8.3.4 Nothing in this Section 8.3 shall authorize the Contractor to recover an increase in the Contract Sum as a result of price escalations in the marketplace or price increases due to labor or materials shortages or to recover such increases in excess of the Contract Sum.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 CONTRACT SUM

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.

§ 9.2 PREVAILING WAGE REQUIREMENTS

Contractor shall provide and pay for labor in accordance with the prevailing wage in the locality and shall not pay less than the prevailing wage.

§ 9.3 SCHEDULE OF VALUES

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit to the Owner and Architect, before the first Application for Payment, a schedule of values allocating the entire Contract Sum to the various portions of the Work and prepared in such form and supported by such data to substantiate its accuracy as the Owner or Architect may require. This schedule, unless objected to by the Owner or Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 9.4 APPLICATIONS FOR PAYMENT

§ 9.4.1 The Contractor must submit to the Architect itemized Application for Payment for Work completed on a monthly basis in accordance with a schedule approved by the Owner. Each Application for Payment must be consistent with the approved Schedule of Values**.** The form of Application for Payment must be AIA Document G702, Application and Certificate for Payment, supported by AIA Document G703, Continuation Sheet (latest edition), or such other form as may be prescribed by the Owner. Such application shall be notarized, if required, and supported by such data substantiating the Contractor's right to payment as the Owner or Architect may require, such as copies of requisitions from Subcontractors and material suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.4.1.1 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.

§ 9.4.1.2 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 material supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ **9.4.2** 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. Cost of materials stored off the construction site may be included in Contractor's request at the sole discretion of the Owner for progress payment, If the following submittals are made and conditions are met:

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1. Contractor shall submit a written narrative giving location of stored materials, provisions for protection of same, and arrangements for transportation of materials to the job site.
2. Contractor shall submit separate Bills of Sale or Invoices on all materials stored off site.
3. Contractor shall submit suitable written evidence that materials stored off site are covered by insurance protection adequate to cover Owner's interests.
4. Contractor shall store materials in facilities that are suitable to protect same from loss and deterioration. Materials shall be separated from other stored materials and shall be clearly labeled as to description, ownership and project destination. Access to stored materials shall be made convenient for inspection that will be made by Architect's representative prior to the issue of each certificate of payment which includes payment for materials stored off site.
5. Payment for materials stored off site shall not affect warranty period for such materials, which period shall commence upon date of final completion of the Work.

§ **9.4.3** The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

§ 9.5 CERTIFICATES FOR PAYMENT

§ 9.5.1 The Architect will, within seven (7) days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Architect determines is properly due, or notify the Contractor and Owner in writing of the Architect's reasons for withholding certification in whole or in part as provided in Section 9.6.1.

§ 9.5.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data comprising the Application for Payment, that, to the best of the Architect's knowledge, information and belief, the Work has progressed to the point indicated and that the quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion and to specific qualifications expressed by the Architect. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, (2) reviewed construction means, methods, techniques, sequences or procedures, (3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment, or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.6 DECISIONS TO WITHHOLD CERTIFICATION

§ 9.6.1 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 9.5.2 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 9.5.1. 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, because of

.1 defective Work not remedied;
.2 third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;
.3 failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
.4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;

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.5 damage to the Owner or a separate contractor;
.6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
.7 repeated failure to carry out the Work in accordance with the Contract Documents.

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

§ 9.6.3 If the Architect withholds certification for payment under Section 9.6.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or material or equipment suppliers to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Architect will reflect such payment on the next Certificate for Payment.

§ 9.7PROGRESS PAYMENTS

§ 9.7.1 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.

§ 9.7.2 The Contractor shall pay each Subcontractor no later than seven (7) days after receipt of payment from the Owner the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.7.3 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.

§ 9.7.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and material and equipment 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 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, except as may otherwise be required by law.

§ 9.7.5 Contractor payments to material and equipment suppliers shall be treated in a manner similar to that provided in Sections 9.7.2, 9.7.3 and 9.7.4.

§ 9.7.6 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.

§ 9.7.7 Payments received by the Contractor for Work properly performed by Subcontractors and suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, shall create any fiduciary liability or tort liability on the part of the Contractor for breach of trust or shall entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision. However, Contractor shall comply with the provisions of the Texas Trust Fund Act, Chapter 162 of the Texas Property Code.

§ 9.8 FAILURE OF PAYMENT

Failure of payment by Owner within the time limits proscribed by chapter 2251 of the Texas Government Code shall entitle the Contractor to the remedies contained in that chapter. Further, should the Owner fail to pay the Contractor any sums for which a Certificate for Payment has been issued within sixty (60) days, the Contractor may suspend performance of the Work until such payment of the amount owing has been received. A suspension under this section shall entitle the Contractor to an increase in the Contract Sum for all costs associated with the suspension provided the Contractor files a claim in accordance with Article 15 herein.

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§ 9.9 SUBSTANTIAL COMPLETION

§ 9.9.1 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; provided, however, as a condition precedent to Substantial Completion, the Owner has received all certificates of occupancy from any governmental authority having jurisdiction thereof necessary for the beneficial occupancy of the Project (or if the same cannot be delivered for reasons not the fault or responsibility of Contractor, nevertheless all Contractor's obligations necessary to the issuance of such certificates will have been performed). In general, the only remaining Work shall be minor in nature, so that the Owner could occupy and utilize the Project on that date and the completion of the Work by the Contractor would not materially interfere or hamper the Owner's normal business operations and the "punchlist" may be completed within 30 calendar days following the Substantial Completion Date (or such other date as required by the Agreement).

§ 9.9.2 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.

§ 9.9.3 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.

§ 9.9.3.1 Inspections required and defined in Paragraphs 9.9.3, and 9.11.1 of the General Conditions are a component of the Architect's Basic Services. Additional inspections which result from the Contractor's failure to complete the Work of the Contract within the specified time are in addition to the Architect's Basic Services and will therefore be the responsibility of the Contractor and said costs shall be deducted by the Owner from the Contractor's Application for Payment. Costs deducted will be based on the Architect's invoices for these additional services. Costs related to additional inspections which results from the Contractor's repeated failure to correct defective or incomplete Work are the responsibility of the Contractor, costs for the additional inspections of the Architect shall be deducted by the Owner from the Contractor's Application for Payment. Costs deducted will be based on the Architect's invoices for cost of additional services and inspections.

§ 9.9.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.9.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. Upon such acceptance and consent of surety, if any, the Owner shall make payment of retainage applying to such 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.

§ 9.10 PARTIAL OCCUPANCY OR USE

§ 9.10.1 The Owner may occupy or use any completed or partially completed portion of the Work provided such occupancy or use is authorized by public authorities having jurisdiction over the Project.

§ 9.10.2 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.

§ 9.10.3Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

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§ 9.11 FINAL COMPLETION AND FINAL PAYMENT

§ 9.11.1 Upon receipt of the Contractor's written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. The Contractor's written notice and request for final inspection constitutes a representation by the Contractor to the Owner that the Work has been completed in full and strict accordance with terms and conditions of the Contract Documents. The Architect will promptly notify the Contractor if the Owner or the Architect do not concur that the Work is finally complete. In such case, the Contractor must bear the cost of any additional services of the Owner or the Architect until the Work is determined to be finally complete. 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 terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.11.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.11.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits the following 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 release or waiver of liens on behalf of the Contractor and a similar release or waiver on behalf of each Subcontractor and supplier;

.3 a certificate evidencing that the Contractor's liability insurance will remain in effect after final payment and will not be cancelled or allowed to expire prior to the period required by these contract documents;

.4 a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents;

.5 consent of surety to final payment;

.6 other data required by the Owner establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be prescribed by the Owner;

.7 a certified building location survey and as-built site plan in the form and number required by the Contract Documents;

.8 all warranties and bonds required by the Contract Documents.

§ 9.11.3 If the Contractor is unable to secure from any Subcontractor or supplier a release or waiver required under the Contract, THE CONTRACTOR AGREES TO INDEMNIFY AND HOLD HARMLESS THE OWNER FOR ANY AND ALL COSTS INCURRED BY THE OWNER IN ADDRESSING, REMOVING, DISCHARGING OR OTHERWISE SETTLING A SUBCONTRACTOR OR SUPPLIER PAYMENT CLAIM, INCLUDING ALL ATTORNEYS' FEES.

§ 9.11.4 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

§ 9.11.5 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

.1 liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;

.2 failure of the Work to comply with the requirements of the Contract Documents; or

.3 terms of special warranties required by the Contract Documents.

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§ 9.11.6 Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 SAFETY PRECAUTIONS AND PROGRAMS

The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 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 all persons at the site and other persons who may be affected by the Work or other operations of the Contractor;

.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 or the Contractor's Subcontractors or Sub-subcontractors; and

.3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

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

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3, except damage or loss attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 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, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

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§ 10.3 HAZARDOUS MATERIALS

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials. In the event the Contractor encounters on the Site material reasonably believed to be a Hazardous Material (other than those for which the Contractor may have specific responsibility for remediation under the Agreement), and the Contractor's reasonable precautions will be inadequate to prevent foreseeable damage or injury and the Contractor cannot proceed with the Work in the absence of the removal, containment or remediation of the Hazardous Material, the Contractor must immediately stop Work in the area affected and report the condition to the Owner and the Architect, in writing, within 24 hours of discovery

§ 10.3.2 Upon receipt of notice of suspected Hazardous Materials, Owner will cause an investigation to be made to verify the presence and extent of such materials, to determine whether such materials are in fact hazardous, and the steps necessary for their removal, containment or remediation.

§ 10.3.3 If the Owner's investigation confirms the presence of Hazardous Materials which present a risk of injury or damage which will not be adequately protected against by the Contractor's reasonable precautions, then the Work in the affected area must not thereafter be resumed except at the written direction of the Owner. The Work in the affected area will be resumed promptly (i) in the absence of a finding of Hazardous Material by the Owner, (ii) upon the removal, containment or remediation of the Hazardous Materials, or (iii) upon the establishment of appropriate safety precautions.

§ 10.3.4 The Contractor may request a change in the Contract Sum or Contract Time if the Contractor incurs additional costs on account of or is delayed by the need to remove, contain or remediate Hazardous Materials which has not been rendered harmless at the Site unless the Contractor is responsible for same under the Agreement. Any such requested change in the Contract Sum or Contract Time must be made in writing within ten (10) days of discovery of any Hazardous Materials, which has not been rendered harmless, pursuant to Articles 7 and 15 herein.

§ 10.3.5 THE CONTRACTOR SHALL INDEMNIFY THE OWNER FOR THE COST AND EXPENSE THE OWNER INCURS (1) FOR REMEDIATION OF A MATERIAL OR SUBSTANCE 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.

§ 10.4 EMERGENCIES

In an emergency affecting safety of persons or property, the Contractor must take all necessary action, without the necessity for any special instruction or authorization from the Owner or Architect, to prevent threatened damage, injury or loss. The Contractor must promptly but in all events within twenty-four (24) hours of the occurrence report such action in writing to the Owner and Architect. If the Contractor incurs additional costs on account of or is delayed by such action, the Contractor may request a change in the Contract Sum or Contract Time to account for such action. Any such requested change in the Contract Sum or Contract Time must be made in writing within ten (10) days of the occurrence, pursuant to Articles 7 and 15 herein. Any adjustment in the Contract Sum or Contract Time shall be limited to the extent that the emergency work is not attributable to the fault or neglect of the Contractor or otherwise the responsibility of the Contractor under the Contract Documents.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 CONTRACTOR'S INSURANCE REQUIREMENTS

The Contractor's insurance requirements are contained in Exhibit A to this Agreement and are incorporated verbatim as if printed herein.

§ 11.2 OWNER'S LIABILITY INSURANCE

The Owner is self-insured and is not required to purchase or maintain liability insurance.

§ 11.3 PROPERTY INSURANCE

The Owner is self-insured and is not required to purchase or maintain property insurance.

§ 11.4 PERFORMANCE BOND AND PAYMENT BOND

§ 11.4.1 The Contractor shall provide performance and payment bonds in accordance with chapter 2253 of the Texas Government Code.

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§ 11.4.2 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

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 and upon written approval by the Owner, 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 , subject to written approval by the Owner, to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such costs and the cost of correction shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

§ 12.2 CORRECTION OF WORK

§ 12.2.1 BEFORE OR AFTER SUBSTANTIAL COMPLETION

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 AFTER SUBSTANTIAL COMPLETION

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Final Completion of the Work (or any longer period expressly required by the Agreement), or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor an express 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 except when emergency repairs are necessary to prevent further damage to the Work or damages to the Owner. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.4. Nothing herein shall be construed to negate or limit Contractor's obligations set forth in Section 3.18 above, including without limitation Contractor's duties to defend and indemnify the Indemnified Parties.

§ 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 Any corrective work performed or to be performed under or pursuant to Section 12.2 shall be warranted to the same extent as the Work is warranted hereunder for the greater of the remainder of the applicable warranty period or ninety (90) days from the date such corrective work has been completed.

§ 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.

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§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or separate contractors caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, 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 State of Texas.

§ 13.2 VENUE

This agreement is entered into and performed in Guadalupe County, Texas, and the Contractor and the Owner agree that mandatory venue for any legal action related to this contract shall be in the District Courts of Guadalupe County, Texas.

§ 13.3 SUCCESSORS AND ASSIGNS

The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to covenants, agreements and obligations contained in the Contract Documents. Neither party to the Contract shall assign the Contract in whole or in part without the express written consent of the other. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract and the attempted assignment shall be of no legal force or effect as to the other party..

§ 13.4 WRITTEN NOTICE

Written notice shall be deemed to have been duly served if delivered in person to the individual, to a member of the firm or entity, or to an officer of the corporation for which it was intended; or if delivered at, or sent by registered or certified mail or by courier service providing proof of delivery to, the last business address known to the party giving notice. Written notice sent or transmitted by electronic mail or facsimile must be actually received to be considered delivered and to comply with notice requirements herein. Transmission alone by electronic mail or facsimile does not constitute delivery.

§ 13.5RIGHTS AND REMEDIES

§ 13.5.1 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.

§ 13.5.2 No action or failure to act by the Owner, Architect or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach there under, except as may be specifically agreed in writing.

§ 13.6 TESTS AND INSPECTIONS

§ 13.6.1 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 appropriate public authority. The Owner shall bear all related costs of tests, inspections and approvals. The Contractor must schedule all tests, inspections or specific approvals

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required by law or the Contract Documents so as to avoid any delay in the Work. The Contractor shall give the the Owner timely notice of when and where tests and inspections are to be made so that the Owner and Architect may be present for such procedures.

§ 13.6.2 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 13.6.1, 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 13.6.3, shall be at the Owner's expense.

§ 13.6.3 If such procedures for testing, inspection or approval under Sections 13.6.1 and 13.6.2 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.

§ 13.5.4 Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.6.5 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.

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

§ 13.6.7 In addition to the tests required by this Section 13.6, the Owner may at any time arrange for other tests, inspections and specific approvals to be performed by others selected by the Owner, at the Owner's expense. The Contractor must cooperate with the Owner and provide access to the Work for such tests, inspections and approvals.

§ 13.7 TIME LIMITS ON CLAIMS

The Owner and Contractor shall commence all claims and causes of action, whether in contract, tort, breach of warranty or otherwise, against the other arising out of or related to the Contract in accordance with the requirements of the final dispute resolution method selected in the Agreement within the time 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 13.7.

§ 13.8 DOCUMENT RETENTION AND AUDIT PROVISIONS

The Contractor shall account for all materials, equipment and labor entering into the Work and must keep such full and detailed records as may be necessary for proper financial management pursuant to the Contract Documents for a period of four years after final payment. Furthermore, the Owner has the right to examine the Contractor's and its Subcontractors' and suppliers' records directly or indirectly pertaining or relating to the Work or the Agreement and the Contractor must grant the Owner access to and an opportunity to copy such records at all reasonable times during the Contract period and for four years after final payment.

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 or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:

.1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;

.2 An act of government, such as a declaration of national emergency that requires all Work to be stopped;

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§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, repeated suspensions, delays or interruptions of the entire Work by the Owner as described in Section 14.3 constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven (7) days' written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, including reasonable overhead and profit, profit on such work, profit on unperformed work, and direct job costs incurred by reason of such termination.

§ 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 for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;

.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 above reasons exist, the Owner may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

.1 Exclude the Contractor from the site and take possession of 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.

§ 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, attorney fees, 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.

§ 14.2.5 In completing the Work following termination for cause, the Owner is not required to solicit competitive bids or to award completion work to the lowest bidder, but may obtain such completion work and related services on the basis of sole source procurement, emergency, and other applicable exemptions pursuant to sections 262.003 and 262.024 of the Local Government Code. In the event of a claim by Owner for completion costs following termination by the Owner or abandonment by the Contractor, the exercise of Owner's rights under this section shall not be grounds for challenging the reasonableness of the costs incurred or the Owner's damages.

§ 14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay or interruption as described in Section 14.3.1. Adjustment of the Contract Sum shall not include additional 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.

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§ 14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall

.1 cease operations as directed by the Owner in the notice, and, if required by the Owner, participate in an inspection of the Work with the Owner and the Architect to record the extent of completion thereof, to identify the Work remaining to be completed or corrected, and to determine what temporary facilities, tools, equipment and construction machinery are to remain at the Site pending completion of the Work;

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed, and direct job costs incurred by reason of such termination, along with profit on the Work not executed.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 CLAIMS

§ 15.1.1 DEFINITION

A Claim is a written demand by one of the parties seeking, as a matter of right, payment of money, 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.

§ 15.1.2 NOTICE OF CLAIMS

Claims by the Contractor must be initiated by written notice (the Notice) to the Owner within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the Contractor first recognizes the condition giving rise to the Claim, whichever is later; provided, however, that the Contractor shall use its best efforts to furnish the Owner and Initial Decision Maker, as expeditiously as possible, with notice of any Claim including, without limitation, those in connection with concealed or unknown conditions, once such Claim is recognized, and shall cooperate with the Owner in any effort to mitigate the alleged or potential damages, delay or other adverse consequences arising out of the condition which is the cause of such a Claim. Any Claim or portion of a Claim that has not been made the specific subject of a notice in accordance with the requirements of this Article shall be waived. The parties acknowledge that it is imperative that the Owner have timely, specific notice of any potential problem in order that the problem can be mitigated promptly and economically

§ 15.1.3 CONTINUING CONTRACT PERFORMANCE

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. The Architect will prepare Change Orders and issue Certificates for Payment in accordance with the decisions of the Initial Decision Maker.

§ 15.1.4 CLAIMS FOR ADDITIONAL COST

If the Contractor wishes to make a Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4. Failure to provide written notice of a Claim in accordance with section 15.1.2 and other applicable provisions of the Contract Documents constitutes an express waiver by the Contractor of any right of recovery on such Claim.

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§ 15.1.5 CLAIMS FOR ADDITIONAL TIME

§ 15.1.5.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, written notice as provided herein shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary. Failure to provide written notice of a Claim in accordance with section 15.1.2 and other applicable provisions of the Contract Documents constitutes an express waiver by the Contractor of any right of recovery on such Claim.

§ 15.1.5.2 Consistent with the requirements of Section 8.3, if adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by reasonable, reliable data substantiating that weather conditions at the Project Site were abnormal for the period of time and resulted in delays due to adverse weather conditions in excess of such days as set forth in the Schedule of the Work incorporated into the Contract Documents, could not have been reasonably anticipated and had an adverse effect on the Critical Path for the scheduled construction.

§ 15.1.6 CLAIMS FOR CONSEQUENTIAL DAMAGES

The Contractor waives claims against The Owner for consequential damages arising out of or relating to this Contract. This waiver includes

.1 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, bonding capacity, business and reputation, and for loss of profit except anticipated profit arising directly from the Work.

This 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 15.1.6 shall be deemed to preclude an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 INITIAL DECISION

§ 15.2.1 Claims, excluding those arising under Sections 10.3, and 10.4, arising out of or relating to this Contract and asserted by Contractor against Owner, shall be referred to the Initial Decision Maker for initial decision. Unless expressly waived by the Parties, in writing, the provisions of this Section 15.2 shall be a condition precedent to any further dispute resolution or adjudication of claims. 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 arising out of or relating to this Contract and asserted by Contractor against Owner prior to the date final payment is due, unless 30 days have passed after the Claim has been referred to the Initial Decision Maker with no 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 such 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.

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§ 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 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.

§ 15.3 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 9.11.4, 9.11.5, and 15.1.6 shall be subject to mediation as a condition precedent to filing suit.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation. A request for mediation shall be made in writing.

§15.3.3 The parties shall select a mediator, as well as the time and location for the mediation, by agreement. Should the parties be unable to agree upon a mediator, the mediation shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of this Agreement.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

« »	« »
OWNER (Signature)	*CONTRACTOR (Signature)*
« Brian James, Acting City Manager»« »	« Renee Fruitt »« President»
(Printed name and title)	*(Printed name and title)*

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CONFLICT OF INTEREST QUESTIONNAIRE

FORM CIQ

For vendor doing business with local governmental entity

This questionnaire reflects changes made to the law by H.B. 23, 84th Leg., Regular Session.

This questionnaire is being filed in accordance with Chapter 176, Local Government Code, by a vendor who has a business relationship as defined by Section 176.001(1-a) with a local governmental entity and the vendor meets requirements under Section 176.006(a).

By law this questionnaire must be filed with the records administrator of the local governmental entity not later than the 7th business day after the date the vendor becomes aware of facts that require the statement to be filed. *See* Section 176.006(a-1), Local Government Code.

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

OFFICE USE ONLY

Date Received

1 **Name of vendor who has a business relationship with local governmental entity.**

2 ☐ **Check this box if you are filing an update to a previously filed questionnaire.** (The law requires that you file an updated completed questionnaire with the appropriate filing authority not later than the 7th business day after the date on which you became aware that the originally filed questionnaire was incomplete or inaccurate.)

3 **Name of local government officer about whom the information is being disclosed.**

_____

Name of Officer

4 **Describe each employment or other business relationship with the local government officer, or a family member of the officer, as described by Section 176.003(a)(2)(A). Also describe any family relationship with the local government officer. Complete subparts A and B for each employment or business relationship described. Attach additional pages to this Form CIQ as necessary.**

A. Is the local government officer or a family member of the officer receiving or likely to receive taxable income, other than investment income, from the vendor?

☐ Yes ☐ No

B. Is the vendor receiving or likely to receive taxable income, other than investment income, from or at the direction of the local government officer or a family member of the officer AND the taxable income is not received from the local governmental entity?

☐ Yes ☐ No

5 **Describe each employment or business relationship that the vendor named in Section 1 maintains with a corporation or other business entity with respect to which the local government officer serves as an officer or director, or holds an ownership interest of one percent or more.**

6 ☐ Check this box if the vendor has given the local government officer or a family member of the officer one or more gifts as described in Section 176.003(a)(2)(B), excluding gifts described in Section 176.003(a-1).

7

_____ _____

Signature of vendor doing business with the governmental entity Date

CONFLICT OF INTEREST QUESTIONNAIRE
For vendor doing business with local governmental entity

A complete copy of Chapter 176 of the Local Government Code may be found at http://www.statutes.legis.state.tx.us/Docs/LG/htm/LG.176.htm. For easy reference, below are some of the sections cited on this form.

Local Government Code § 176.001(1-a): "Business relationship" means a connection between two or more parties based on commercial activity of one of the parties. The term does not include a connection based on:

(A) a transaction that is subject to rate or fee regulation by a federal, state, or local governmental entity or an agency of a federal, state, or local governmental entity;

(B) a transaction conducted at a price and subject to terms available to the public; or

(C) a purchase or lease of goods or services from a person that is chartered by a state or federal agency and that is subject to regular examination by, and reporting to, that agency.

Local Government Code § 176.003(a)(2)(A) and (B):

(a) A local government officer shall file a conflicts disclosure statement with respect to a vendor if:

***

(2) the vendor:

(A) has an employment or other business relationship with the local government officer or a family member of the officer that results in the officer or family member receiving taxable income, other than investment income, that exceeds $2,500 during the 12-month period preceding the date that the officer becomes aware that

(i) a contract between the local governmental entity and vendor has been executed; or

(ii) the local governmental entity is considering entering into a contract with the vendor;

(B) has given to the local government officer or a family member of the officer one or more gifts that have an aggregate value of more than $100 in the 12-month period preceding the date the officer becomes aware that:

(i) a contract between the local governmental entity and vendor has been executed; or

(ii) the local governmental entity is considering entering into a contract with the vendor.

Local Government Code § 176.006(a) and (a-1)

(a) A vendor shall file a completed conflict of interest questionnaire if the vendor has a business relationship with a local governmental entity and:

(1) has an employment or other business relationship with a local government officer of that local governmental entity, or a family member of the officer, described by Section 176.003(a)(2)(A);

(2) has given a local government officer of that local governmental entity, or a family member of the officer, one or more gifts with the aggregate value specified by Section 176.003(a)(2)(B), excluding any gift described by Section 176.003(a-1); or

(3) has a family relationship with a local government officer of that local governmental entity.

(a-1) The completed conflict of interest questionnaire must be filed with the appropriate records administrator not later than the seventh business day after the later of:

(1) the date that the vendor:

(A) begins discussions or negotiations to enter into a contract with the local governmental entity; or

(B) submits to the local governmental entity an application, response to a request for proposals or bids, correspondence, or another writing related to a potential contract with the local governmental entity; or

(2) the date the vendor becomes aware:

(A) of an employment or other business relationship with a local government officer, or a family member of the officer, described by Subsection (a);

(B) that the vendor has given one or more gifts described by Subsection (a); or

(C) of a family relationship with a local government officer.

FELONY CONVICTION NOTIFICATION

State of Texas Legislative Senate Bill No. 1, Section 44.034, Notification of Criminal History, Subsection (a), states "a person or business entity that enters into a contract with a school district must give advance notice to the district if the person, owner or operator of the business entity has been convicted of a felony." The notice must include a general description of the conduct resulting in the conviction of a felony.

Subsection (b) states "a school district may terminate a contract with a person or business entity if the district determines that the person or business entity failed to give notice as required by Subsection (a) or misrepresented the conduct resulting in the conviction." The district must compensate the person or business entity for services performed before the termination of the contract.

THIS NOTICE IS NOT REQUIRED OF A PUBLICLY -HELD CORPORATION, BUT THE COMPANY REPRESENTATIVE MUST CHECK OFF A SELECTION BELOW (A, B OR C)

I, the undersigned agent for the firm named below, certify that the information concerning notification of felony convictions has been reviewed by me and the following information furnished is true to the best of my knowledge.

VENDOR'S NAME: _____

_____
AUTHORIZED COMPANY OFFICIAL'S NAME (PRINTED)

_____
AUTHORIZED COMPANY OFFICIAL'S SIGNATURE

Date: _____

PLEASE CHECK OFF A SELECTION BELOW

( ) A. My firm is a publicly-held corporation, therefore, this report requirement is not applicable.
( ) B. My firm is not owned and/or operated by anyone who has been convicted of a felony.
( ) C. My firm is owned or operated by the following individual (s) who has/have been convicted of a felony.

Name of Felon (s) _____
Details of conviction(s):_____

INSTRUCTIONS FOR CERTIFICATE OF INTERESTED PARTIES FORM 1295

In 2015, the Texas Legislature adopted House Bill 1295, which added section 2252.908 to the Texas Government Code, Chapter 2252, Subchapter Z, (hereafter referred to as "the Code"), and applies to all contracts entered into on or after January 1, 2016. The Code states Cameron Appraisal District may not enter into a contract with a business entity unless and until the business entity has submitted a Certificate of Interested Parties (hereafter referred to as "Form 1295") to Cameron County for filing with the Texas Ethics Commission (hereafter referred to as "TEC"). The Form 1295 requirement imposed upon Cameron Appraisal District applies to ALL contracts:

- requiring Cameron Appraisal District's approval; and/or
- renewals, extensions or amendments that must be approved by the Cameron County Commissioners

TEC has made available on its website the new filing application that must be used by prospective vendors to file its Form 1295 with Cameron County. Prospective vendors must use TEC's application to enter the required information on Form 1295 and print a copy of the completed form containing a unique certification number for its bid or proposal. An authorized agent of the prospective vendor then must sign the printed copy of the completed form and have the Form 1295 notarized. The notarized completed Form 1295 containing the unique certification number then must be submitted with the prospective vendor's bid or proposed contract to Cameron Appraisal District to ensure both Cameron Appraisal District and prospective vendor meet the Code requirements.

Form 1295 must be completed on-line by the business entity. It is accessible at:

https://www.ethics.state.tx.us/whatsnew/elf_info_form1295.htm

Instructional videos on logging in and creating Form 1295 are provided on the above TEC website.

Each prospective vendor should take appropriate steps prior to completion of Form 1295 to familiarize itself with the Code and the TEC rules published in Title 1, Part 2, Chapter 46 of the Texas Administrative Code. The business entity takes full responsibility for completing the form and interpreting the Code. Questions may be directed to TEC during normal business hours at 512-463-5800.

The completed, signed and notarized Form 1295 must be mailed to or provided with a bidders response to the Request for Bids:

Cameron Appraisal District
2021 Amistad Dr.
San Benito, Texas 78586

Cameron Appraisal District will notify the TEC, using the TEC's filing application, of the receipt of the filed Form 1295 and certification of filing not later than the 30th day after the execution of the contract by Cameron Appraisal District and the vendor.

Form **W-9**
(Rev. November 2017)
Department of the Treasury
Internal Revenue Service

Request for Taxpayer Identification Number and Certification

► **Go to *www.irs.gov/FormW9* for instructions and the latest information.**

Give Form to the requester. Do not send to the IRS.

Print or type. See **Specific Instructions** on page 3.

1 Name (as shown on your income tax return). Name is required on this line; do not leave this line blank.

2 Business name/disregarded entity name, if different from above

3 Check appropriate box for federal tax classification of the person whose name is entered on line 1. Check only **one** of the following seven boxes.

☐ Individual/sole proprietor or single-member LLC ☐ C Corporation ☐ S Corporation ☐ Partnership ☐ Trust/estate

☐ Limited liability company. Enter the tax classification (C=C corporation, S=S corporation, P=Partnership) ► _____

Note: Check the appropriate box in the line above for the tax classification of the single-member owner. Do not check LLC if the LLC is classified as a single-member LLC that is disregarded from the owner unless the owner of the LLC is another LLC that is **not** disregarded from the owner for U.S. federal tax purposes. Otherwise, a single-member LLC that is disregarded from the owner should check the appropriate box for the tax classification of its owner.

☐ Other (see instructions) ►

4 Exemptions (codes apply only to certain entities, not individuals; see instructions on page 3):

Exempt payee code (if any) _____

Exemption from FATCA reporting code (if any) _____

(Applies to accounts maintained outside the U.S.)

5 Address (number, street, and apt. or suite no.) See instructions.

Requester's name and address (optional)

6 City, state, and ZIP code

7 List account number(s) here (optional)

Part I Taxpayer Identification Number (TIN)

Enter your TIN in the appropriate box. The TIN provided must match the name given on line 1 to avoid backup withholding. For individuals, this is generally your social security number (SSN). However, for a resident alien, sole proprietor, or disregarded entity, see the instructions for Part I, later. For other entities, it is your employer identification number (EIN). If you do not have a number, see *How to get a TIN,* later.

Note: If the account is in more than one name, see the instructions for line 1. Also see *What Name and Number To Give the Requester* for guidelines on whose number to enter.

Social security number

			–			–				

or

Employer identification number

		–							

Part II Certification

Under penalties of perjury, I certify that:

1. The number shown on this form is my correct taxpayer identification number (or I am waiting for a number to be issued to me); and
2. I am not subject to backup withholding because: (a) I am exempt from backup withholding, or (b) I have not been notified by the Internal Revenue Service (IRS) that I am subject to backup withholding as a result of a failure to report all interest or dividends, or (c) the IRS has notified me that I am no longer subject to backup withholding; and
3. I am a U.S. citizen or other U.S. person (defined below); and
4. The FATCA code(s) entered on this form (if any) indicating that I am exempt from FATCA reporting is correct.

Certification instructions. You must cross out item 2 above if you have been notified by the IRS that you are currently subject to backup withholding because you have failed to report all interest and dividends on your tax return. For real estate transactions, item 2 does not apply. For mortgage interest paid, acquisition or abandonment of secured property, cancellation of debt, contributions to an individual retirement arrangement (IRA), and generally, payments other than interest and dividends, you are not required to sign the certification, but you must provide your correct TIN. See the instructions for Part II, later.

Sign Here	**Signature of U.S. person** ►	**Date** ►

General Instructions

Section references are to the Internal Revenue Code unless otherwise noted.

Future developments. For the latest information about developments related to Form W-9 and its instructions, such as legislation enacted after they were published, go to *www.irs.gov/FormW9.*

Purpose of Form

An individual or entity (Form W-9 requester) who is required to file an information return with the IRS must obtain your correct taxpayer identification number (TIN) which may be your social security number (SSN), individual taxpayer identification number (ITIN), adoption taxpayer identification number (ATIN), or employer identification number (EIN), to report on an information return the amount paid to you, or other amount reportable on an information return. Examples of information returns include, but are not limited to, the following.

- Form 1099-INT (interest earned or paid)
- Form 1099-DIV (dividends, including those from stocks or mutual funds)
- Form 1099-MISC (various types of income, prizes, awards, or gross proceeds)
- Form 1099-B (stock or mutual fund sales and certain other transactions by brokers)
- Form 1099-S (proceeds from real estate transactions)
- Form 1099-K (merchant card and third party network transactions)
- Form 1098 (home mortgage interest), 1098-E (student loan interest), 1098-T (tuition)
- Form 1099-C (canceled debt)
- Form 1099-A (acquisition or abandonment of secured property)

Use Form W-9 only if you are a U.S. person (including a resident alien), to provide your correct TIN.

If you do not return Form W-9 to the requester with a TIN, you might be subject to backup withholding. See What is backup withholding, *later.*

By signing the filled-out form, you:

1. Certify that the TIN you are giving is correct (or you are waiting for a number to be issued),

2. Certify that you are not subject to backup withholding, or

3. Claim exemption from backup withholding if you are a U.S. exempt payee. If applicable, you are also certifying that as a U.S. person, your allocable share of any partnership income from a U.S. trade or business is not subject to the withholding tax on foreign partners' share of effectively connected income, and

4. Certify that FATCA code(s) entered on this form (if any) indicating that you are exempt from the FATCA reporting, is correct. See *What is FATCA reporting,* later, for further information.

Note: If you are a U.S. person and a requester gives you a form other than Form W-9 to request your TIN, you must use the requester's form if it is substantially similar to this Form W-9.

Definition of a U.S. person. For federal tax purposes, you are considered a U.S. person if you are:

- An individual who is a U.S. citizen or U.S. resident alien;
- A partnership, corporation, company, or association created or organized in the United States or under the laws of the United States;
- An estate (other than a foreign estate); or
- A domestic trust (as defined in Regulations section 301.7701-7).

Special rules for partnerships. Partnerships that conduct a trade or business in the United States are generally required to pay a withholding tax under section 1446 on any foreign partners' share of effectively connected taxable income from such business. Further, in certain cases where a Form W-9 has not been received, the rules under section 1446 require a partnership to presume that a partner is a foreign person, and pay the section 1446 withholding tax. Therefore, if you are a U.S. person that is a partner in a partnership conducting a trade or business in the United States, provide Form W-9 to the partnership to establish your U.S. status and avoid section 1446 withholding on your share of partnership income.

In the cases below, the following person must give Form W-9 to the partnership for purposes of establishing its U.S. status and avoiding withholding on its allocable share of net income from the partnership conducting a trade or business in the United States.

- In the case of a disregarded entity with a U.S. owner, the U.S. owner of the disregarded entity and not the entity;
- In the case of a grantor trust with a U.S. grantor or other U.S. owner, generally, the U.S. grantor or other U.S. owner of the grantor trust and not the trust; and
- In the case of a U.S. trust (other than a grantor trust), the U.S. trust (other than a grantor trust) and not the beneficiaries of the trust.

Foreign person. If you are a foreign person or the U.S. branch of a foreign bank that has elected to be treated as a U.S. person, do not use Form W-9. Instead, use the appropriate Form W-8 or Form 8233 (see Pub. 515, Withholding of Tax on Nonresident Aliens and Foreign Entities).

Nonresident alien who becomes a resident alien. Generally, only a nonresident alien individual may use the terms of a tax treaty to reduce or eliminate U.S. tax on certain types of income. However, most tax treaties contain a provision known as a "saving clause." Exceptions specified in the saving clause may permit an exemption from tax to continue for certain types of income even after the payee has otherwise become a U.S. resident alien for tax purposes.

If you are a U.S. resident alien who is relying on an exception contained in the saving clause of a tax treaty to claim an exemption from U.S. tax on certain types of income, you must attach a statement to Form W-9 that specifies the following five items.

1. The treaty country. Generally, this must be the same treaty under which you claimed exemption from tax as a nonresident alien.

2. The treaty article addressing the income.

3. The article number (or location) in the tax treaty that contains the saving clause and its exceptions.

4. The type and amount of income that qualifies for the exemption from tax.

5. Sufficient facts to justify the exemption from tax under the terms of the treaty article.

Example. Article 20 of the U.S.-China income tax treaty allows an exemption from tax for scholarship income received by a Chinese student temporarily present in the United States. Under U.S. law, this student will become a resident alien for tax purposes if his or her stay in the United States exceeds 5 calendar years. However, paragraph 2 of the first Protocol to the U.S.-China treaty (dated April 30, 1984) allows the provisions of Article 20 to continue to apply even after the Chinese student becomes a resident alien of the United States. A Chinese student who qualifies for this exception (under paragraph 2 of the first protocol) and is relying on this exception to claim an exemption from tax on his or her scholarship or fellowship income would attach to Form W-9 a statement that includes the information described above to support that exemption.

If you are a nonresident alien or a foreign entity, give the requester the appropriate completed Form W-8 or Form 8233.

Backup Withholding

What is backup withholding? Persons making certain payments to you must under certain conditions withhold and pay to the IRS 28% of such payments. This is called "backup withholding." Payments that may be subject to backup withholding include interest, tax-exempt interest, dividends, broker and barter exchange transactions, rents, royalties, nonemployee pay, payments made in settlement of payment card and third party network transactions, and certain payments from fishing boat operators. Real estate transactions are not subject to backup withholding.

You will not be subject to backup withholding on payments you receive if you give the requester your correct TIN, make the proper certifications, and report all your taxable interest and dividends on your tax return.

Payments you receive will be subject to backup withholding if:

1. You do not furnish your TIN to the requester,

2. You do not certify your TIN when required (see the instructions for Part II for details),

3. The IRS tells the requester that you furnished an incorrect TIN,

4. The IRS tells you that you are subject to backup withholding because you did not report all your interest and dividends on your tax return (for reportable interest and dividends only), or

5. You do not certify to the requester that you are not subject to backup withholding under 4 above (for reportable interest and dividend accounts opened after 1983 only).

Certain payees and payments are exempt from backup withholding. See *Exempt payee code,* later, and the separate Instructions for the Requester of Form W-9 for more information.

Also see *Special rules for partnerships,* earlier.

What is FATCA Reporting?

The Foreign Account Tax Compliance Act (FATCA) requires a participating foreign financial institution to report all United States account holders that are specified United States persons. Certain payees are exempt from FATCA reporting. See *Exemption from FATCA reporting code,* later, and the Instructions for the Requester of Form W-9 for more information.

Updating Your Information

You must provide updated information to any person to whom you claimed to be an exempt payee if you are no longer an exempt payee and anticipate receiving reportable payments in the future from this person. For example, you may need to provide updated information if you are a C corporation that elects to be an S corporation, or if you no longer are tax exempt. In addition, you must furnish a new Form W-9 if the name or TIN changes for the account; for example, if the grantor of a grantor trust dies.

Penalties

Failure to furnish TIN. If you fail to furnish your correct TIN to a requester, you are subject to a penalty of $50 for each such failure unless your failure is due to reasonable cause and not to willful neglect.

Civil penalty for false information with respect to withholding. If you make a false statement with no reasonable basis that results in no backup withholding, you are subject to a $500 penalty.

Criminal penalty for falsifying information. Willfully falsifying certifications or affirmations may subject you to criminal penalties including fines and/or imprisonment.

Misuse of TINs. If the requester discloses or uses TINs in violation of federal law, the requester may be subject to civil and criminal penalties.

Specific Instructions

Line 1

You must enter one of the following on this line; **do not** leave this line blank. The name should match the name on your tax return.

If this Form W-9 is for a joint account (other than an account maintained by a foreign financial institution (FFI)), list first, and then circle, the name of the person or entity whose number you entered in Part I of Form W-9. If you are providing Form W-9 to an FFI to document a joint account, each holder of the account that is a U.S. person must provide a Form W-9.

a. **Individual.** Generally, enter the name shown on your tax return. If you have changed your last name without informing the Social Security Administration (SSA) of the name change, enter your first name, the last name as shown on your social security card, and your new last name.

Note: ITIN applicant: Enter your individual name as it was entered on your Form W-7 application, line 1a. This should also be the same as the name you entered on the Form 1040/1040A/1040EZ you filed with your application.

b. **Sole proprietor or single-member LLC.** Enter your individual name as shown on your 1040/1040A/1040EZ on line 1. You may enter your business, trade, or "doing business as" (DBA) name on line 2.

c. **Partnership, LLC that is not a single-member LLC, C corporation, or S corporation.** Enter the entity's name as shown on the entity's tax return on line 1 and any business, trade, or DBA name on line 2.

d. **Other entities.** Enter your name as shown on required U.S. federal tax documents on line 1. This name should match the name shown on the charter or other legal document creating the entity. You may enter any business, trade, or DBA name on line 2.

e. **Disregarded entity.** For U.S. federal tax purposes, an entity that is disregarded as an entity separate from its owner is treated as a "disregarded entity." See Regulations section 301.7701-2(c)(2)(iii). Enter the owner's name on line 1. The name of the entity entered on line 1 should never be a disregarded entity. The name on line 1 should be the name shown on the income tax return on which the income should be reported. For example, if a foreign LLC that is treated as a disregarded entity for U.S. federal tax purposes has a single owner that is a U.S. person, the U.S. owner's name is required to be provided on line 1. If the direct owner of the entity is also a disregarded entity, enter the first owner that is not disregarded for federal tax purposes. Enter the disregarded entity's name on line 2, "Business name/disregarded entity name." If the owner of the disregarded entity is a foreign person, the owner must complete an appropriate Form W-8 instead of a Form W-9. This is the case even if the foreign person has a U.S. TIN.

Line 2

If you have a business name, trade name, DBA name, or disregarded entity name, you may enter it on line 2.

Line 3

Check the appropriate box on line 3 for the U.S. federal tax classification of the person whose name is entered on line 1. Check only one box on line 3.

IF the entity/person on line 1 is a(n) . . .	THEN check the box for . . .
• Corporation	Corporation
• Individual • Sole proprietorship, or • Single-member limited liability company (LLC) owned by an individual and disregarded for U.S. federal tax purposes.	Individual/sole proprietor or single-member LLC
• LLC treated as a partnership for U.S. federal tax purposes, • LLC that has filed Form 8832 or 2553 to be taxed as a corporation, or • LLC that is disregarded as an entity separate from its owner but the owner is another LLC that is not disregarded for U.S. federal tax purposes.	Limited liability company and enter the appropriate tax classification. (P= Partnership; C= C corporation; or S= S corporation)
• Partnership	Partnership
• Trust/estate	Trust/estate

Line 4, Exemptions

If you are exempt from backup withholding and/or FATCA reporting, enter in the appropriate space on line 4 any code(s) that may apply to you.

Exempt payee code.

- Generally, individuals (including sole proprietors) are not exempt from backup withholding.
- Except as provided below, corporations are exempt from backup withholding for certain payments, including interest and dividends.
- Corporations are not exempt from backup withholding for payments made in settlement of payment card or third party network transactions.
- Corporations are not exempt from backup withholding with respect to attorneys' fees or gross proceeds paid to attorneys, and corporations that provide medical or health care services are not exempt with respect to payments reportable on Form 1099-MISC.

The following codes identify payees that are exempt from backup withholding. Enter the appropriate code in the space in line 4.

1—An organization exempt from tax under section 501(a), any IRA, or a custodial account under section 403(b)(7) if the account satisfies the requirements of section 401(f)(2)

2—The United States or any of its agencies or instrumentalities

3—A state, the District of Columbia, a U.S. commonwealth or possession, or any of their political subdivisions or instrumentalities

4—A foreign government or any of its political subdivisions, agencies, or instrumentalities

5—A corporation

6—A dealer in securities or commodities required to register in the United States, the District of Columbia, or a U.S. commonwealth or possession

7—A futures commission merchant registered with the Commodity Futures Trading Commission

8—A real estate investment trust

9—An entity registered at all times during the tax year under the Investment Company Act of 1940

10—A common trust fund operated by a bank under section 584(a)

11—A financial institution

12—A middleman known in the investment community as a nominee or custodian

13—A trust exempt from tax under section 664 or described in section 4947

The following chart shows types of payments that may be exempt from backup withholding. The chart applies to the exempt payees listed above, 1 through 13.

IF the payment is for . . .	THEN the payment is exempt for . . .
Interest and dividend payments	All exempt payees except for 7
Broker transactions	Exempt payees 1 through 4 and 6 through 11 and all C corporations. S corporations must not enter an exempt payee code because they are exempt only for sales of noncovered securities acquired prior to 2012.
Barter exchange transactions and patronage dividends	Exempt payees 1 through 4
Payments over $600 required to be reported and direct sales over $5,000[1]	Generally, exempt payees 1 through 5[2]
Payments made in settlement of payment card or third party network transactions	Exempt payees 1 through 4

[1] See Form 1099-MISC, Miscellaneous Income, and its instructions.

[2] However, the following payments made to a corporation and reportable on Form 1099-MISC are not exempt from backup withholding: medical and health care payments, attorneys' fees, gross proceeds paid to an attorney reportable under section 6045(f), and payments for services paid by a federal executive agency.

Exemption from FATCA reporting code. The following codes identify payees that are exempt from reporting under FATCA. These codes apply to persons submitting this form for accounts maintained outside of the United States by certain foreign financial institutions. Therefore, if you are only submitting this form for an account you hold in the United States, you may leave this field blank. Consult with the person requesting this form if you are uncertain if the financial institution is subject to these requirements. A requester may indicate that a code is not required by providing you with a Form W-9 with "Not Applicable" (or any similar indication) written or printed on the line for a FATCA exemption code.

A—An organization exempt from tax under section 501(a) or any individual retirement plan as defined in section 7701(a)(37)

B—The United States or any of its agencies or instrumentalities

C—A state, the District of Columbia, a U.S. commonwealth or possession, or any of their political subdivisions or instrumentalities

D—A corporation the stock of which is regularly traded on one or more established securities markets, as described in Regulations section 1.1472-1(c)(1)(i)

E—A corporation that is a member of the same expanded affiliated group as a corporation described in Regulations section 1.1472-1(c)(1)(i)

F—A dealer in securities, commodities, or derivative financial instruments (including notional principal contracts, futures, forwards, and options) that is registered as such under the laws of the United States or any state

G—A real estate investment trust

H—A regulated investment company as defined in section 851 or an entity registered at all times during the tax year under the Investment Company Act of 1940

I—A common trust fund as defined in section 584(a)

J—A bank as defined in section 581

K—A broker

L—A trust exempt from tax under section 664 or described in section 4947(a)(1)

M—A tax exempt trust under a section 403(b) plan or section 457(g) plan

Note: You may wish to consult with the financial institution requesting this form to determine whether the FATCA code and/or exempt payee code should be completed.

Line 5

Enter your address (number, street, and apartment or suite number). This is where the requester of this Form W-9 will mail your information returns. If this address differs from the one the requester already has on file, write NEW at the top. If a new address is provided, there is still a chance the old address will be used until the payor changes your address in their records.

Line 6

Enter your city, state, and ZIP code.

Part I. Taxpayer Identification Number (TIN)

Enter your TIN in the appropriate box. If you are a resident alien and you do not have and are not eligible to get an SSN, your TIN is your IRS individual taxpayer identification number (ITIN). Enter it in the social security number box. If you do not have an ITIN, see *How to get a TIN* below.

If you are a sole proprietor and you have an EIN, you may enter either your SSN or EIN.

If you are a single-member LLC that is disregarded as an entity separate from its owner, enter the owner's SSN (or EIN, if the owner has one). Do not enter the disregarded entity's EIN. If the LLC is classified as a corporation or partnership, enter the entity's EIN.

Note: See *What Name and Number To Give the Requester,* later, for further clarification of name and TIN combinations.

How to get a TIN. If you do not have a TIN, apply for one immediately. To apply for an SSN, get Form SS-5, Application for a Social Security Card, from your local SSA office or get this form online at *www.SSA.gov*. You may also get this form by calling 1-800-772-1213. Use Form W-7, Application for IRS Individual Taxpayer Identification Number, to apply for an ITIN, or Form SS-4, Application for Employer Identification Number, to apply for an EIN. You can apply for an EIN online by accessing the IRS website at *www.irs.gov/Businesses* and clicking on Employer Identification Number (EIN) under Starting a Business. Go to *www.irs.gov/Forms* to view, download, or print Form W-7 and/or Form SS-4. Or, you can go to *www.irs.gov/OrderForms* to place an order and have Form W-7 and/or SS-4 mailed to you within 10 business days.

If you are asked to complete Form W-9 but do not have a TIN, apply for a TIN and write "Applied For" in the space for the TIN, sign and date the form, and give it to the requester. For interest and dividend payments, and certain payments made with respect to readily tradable instruments, generally you will have 60 days to get a TIN and give it to the requester before you are subject to backup withholding on payments. The 60-day rule does not apply to other types of payments. You will be subject to backup withholding on all such payments until you provide your TIN to the requester.

Note: Entering "Applied For" means that you have already applied for a TIN or that you intend to apply for one soon.

Caution: A disregarded U.S. entity that has a foreign owner must use the appropriate Form W-8.

Part II. Certification

To establish to the withholding agent that you are a U.S. person, or resident alien, sign Form W-9. You may be requested to sign by the withholding agent even if item 1, 4, or 5 below indicates otherwise.

For a joint account, only the person whose TIN is shown in Part I should sign (when required). In the case of a disregarded entity, the person identified on line 1 must sign. Exempt payees, see *Exempt payee code,* earlier.

Signature requirements. Complete the certification as indicated in items 1 through 5 below.

1. Interest, dividend, and barter exchange accounts opened before 1984 and broker accounts considered active during 1983. You must give your correct TIN, but you do not have to sign the certification.

2. Interest, dividend, broker, and barter exchange accounts opened after 1983 and broker accounts considered inactive during 1983. You must sign the certification or backup withholding will apply. If you are subject to backup withholding and you are merely providing your correct TIN to the requester, you must cross out item 2 in the certification before signing the form.

3. Real estate transactions. You must sign the certification. You may cross out item 2 of the certification.

4. Other payments. You must give your correct TIN, but you do not have to sign the certification unless you have been notified that you have previously given an incorrect TIN. "Other payments" include payments made in the course of the requester's trade or business for rents, royalties, goods (other than bills for merchandise), medical and health care services (including payments to corporations), payments to a nonemployee for services, payments made in settlement of payment card and third party network transactions, payments to certain fishing boat crew members and fishermen, and gross proceeds paid to attorneys (including payments to corporations).

5. Mortgage interest paid by you, acquisition or abandonment of secured property, cancellation of debt, qualified tuition program payments (under section 529), ABLE accounts (under section 529A), IRA, Coverdell ESA, Archer MSA or HSA contributions or distributions, and pension distributions. You must give your correct TIN, but you do not have to sign the certification.

What Name and Number To Give the Requester

For this type of account:	Give name and SSN of:
1. Individual	The individual
2. Two or more individuals (joint account) other than an account maintained by an FFI	The actual owner of the account or, if combined funds, the first individual on the account[1]
3. Two or more U.S. persons (joint account maintained by an FFI)	Each holder of the account
4. Custodial account of a minor (Uniform Gift to Minors Act)	The minor[2]
5. a. The usual revocable savings trust (grantor is also trustee) b. So-called trust account that is not a legal or valid trust under state law	The grantor-trustee[1] The actual owner[1]
6. Sole proprietorship or disregarded entity owned by an individual	The owner[3]
7. Grantor trust filing under Optional Form 1099 Filing Method 1 (see Regulations section 1.671-4(b)(2)(i)(A))	The grantor*
For this type of account:	**Give name and EIN of:**
8. Disregarded entity not owned by an individual	The owner
9. A valid trust, estate, or pension trust	Legal entity[4]
10. Corporation or LLC electing corporate status on Form 8832 or Form 2553	The corporation
11. Association, club, religious, charitable, educational, or other tax-exempt organization	The organization
12. Partnership or multi-member LLC	The partnership
13. A broker or registered nominee	The broker or nominee
14. Account with the Department of Agriculture in the name of a public entity (such as a state or local government, school district, or prison) that receives agricultural program payments	The public entity
15. Grantor trust filing under the Form 1041 Filing Method or the Optional Form 1099 Filing Method 2 (see Regulations section 1.671-4(b)(2)(i)(B))	The trust

[1] List first and circle the name of the person whose number you furnish. If only one person on a joint account has an SSN, that person's number must be furnished.

[2] Circle the minor's name and furnish the minor's SSN.

[3] You must show your individual name and you may also enter your business or DBA name on the "Business name/disregarded entity" name line. You may use either your SSN or EIN (if you have one), but the IRS encourages you to use your SSN.

[4] List first and circle the name of the trust, estate, or pension trust. (Do not furnish the TIN of the personal representative or trustee unless the legal entity itself is not designated in the account title.) Also see *Special rules for partnerships,* earlier.

***Note:** The grantor also must provide a Form W-9 to trustee of trust.

Note: If no name is circled when more than one name is listed, the number will be considered to be that of the first name listed.

Secure Your Tax Records From Identity Theft

Identity theft occurs when someone uses your personal information such as your name, SSN, or other identifying information, without your permission, to commit fraud or other crimes. An identity thief may use your SSN to get a job or may file a tax return using your SSN to receive a refund.

To reduce your risk:

- Protect your SSN,
- Ensure your employer is protecting your SSN, and
- Be careful when choosing a tax preparer.

If your tax records are affected by identity theft and you receive a notice from the IRS, respond right away to the name and phone number printed on the IRS notice or letter.

If your tax records are not currently affected by identity theft but you think you are at risk due to a lost or stolen purse or wallet, questionable credit card activity or credit report, contact the IRS Identity Theft Hotline at 1-800-908-4490 or submit Form 14039.

For more information, see Pub. 5027, Identity Theft Information for Taxpayers.

Victims of identity theft who are experiencing economic harm or a systemic problem, or are seeking help in resolving tax problems that have not been resolved through normal channels, may be eligible for Taxpayer Advocate Service (TAS) assistance. You can reach TAS by calling the TAS toll-free case intake line at 1-877-777-4778 or TTY/TDD 1-800-829-4059.

Protect yourself from suspicious emails or phishing schemes. Phishing is the creation and use of email and websites designed to mimic legitimate business emails and websites. The most common act is sending an email to a user falsely claiming to be an established legitimate enterprise in an attempt to scam the user into surrendering private information that will be used for identity theft.

The IRS does not initiate contacts with taxpayers via emails. Also, the IRS does not request personal detailed information through email or ask taxpayers for the PIN numbers, passwords, or similar secret access information for their credit card, bank, or other financial accounts.

If you receive an unsolicited email claiming to be from the IRS, forward this message to *phishing@irs.gov.* You may also report misuse of the IRS name, logo, or other IRS property to the Treasury Inspector General for Tax Administration (TIGTA) at 1-800-366-4484. You can forward suspicious emails to the Federal Trade Commission at *spam@uce.gov* or report them at *www.ftc.gov/complaint.* You can contact the FTC at *www.ftc.gov/idtheft* or 877-IDTHEFT (877-438-4338). If you have been the victim of identity theft, see *www.IdentityTheft.gov* and Pub. 5027.

Visit *www.irs.gov/IdentityTheft* to learn more about identity theft and how to reduce your risk.

Privacy Act Notice

Section 6109 of the Internal Revenue Code requires you to provide your correct TIN to persons (including federal agencies) who are required to file information returns with the IRS to report interest, dividends, or certain other income paid to you; mortgage interest you paid; the acquisition or abandonment of secured property; the cancellation of debt; or contributions you made to an IRA, Archer MSA, or HSA. The person collecting this form uses the information on the form to file information returns with the IRS, reporting the above information. Routine uses of this information include giving it to the Department of Justice for civil and criminal litigation and to cities, states, the District of Columbia, and U.S. commonwealths and possessions for use in administering their laws. The information also may be disclosed to other countries under a treaty, to federal and state agencies to enforce civil and criminal laws, or to federal law enforcement and intelligence agencies to combat terrorism. You must provide your TIN whether or not you are required to file a tax return. Under section 3406, payers must generally withhold a percentage of taxable interest, dividend, and certain other payments to a payee who does not give a TIN to the payer. Certain penalties may also apply for providing false or fraudulent information.

SECTION 00801 – DRAWING INDEX

TP1	TITLE PAGE
C1.0	GENERAL NOTES
C1.1	GENERAL NOTES
C2.0	DEMO/EXISTING TOPO PLAN
C3.0	SITE PLAN
C4.0	SWPPP
C5.0	WATER DETAILS
C6.0	PAVING DETAILS
AC1	OVERALL SITE, PROPOSED SITE PLAN
AC1.1	PROPOSED SITE PLAN AND SITE DETAILS
	NEW BUILDING ADDITION:
A1	FLOOR PLAN AND DETAILS
A1.1	RESTROOM PLAN AND INTERIOR ELEVATIONS & INTERIOR BLDG. ELEVATIONS
A1.2	REFLECTIVE CEILING PLAN AND DETAILS
A2	EXTERIOR ELEVATIONS AND BUILDING SECTIONS
A2.1	ROOF PLAN AND ROOF DETAILS
A3	WALL SECTIONS
A3.1	WALL SECTIONS AND DETAILS
A4	SCHEDULES, DOOR & FRAME TYPES, WINDOW TYPES & WALL TYPES
A5	DOOR AND WINDOW DETAILS
	EXISTING BUILDING:
DA1	EXISTING AND DEMOLITION FLOOR PLAN
DA2	EXISTING ROOF REPAIRS AND REPLACEMENT PLAN
R-A1	RECEPTION AND RESTROOM PLAN
R-A1.1	ENLARGED RESTROOM PLAN
R-A1.2	REFLECTIVE CLG. FOR WAITING AREA, RECEPTION AND RESTROOMS
R-A2	EXTERIOR ELEVATIONS AND BUILDING SECTION
R-A2.1	ROOF DETAILS - CRAFTSMAN
R-A3	INTERIOR ELEVATIONS
R-A3.1	INTERIOR ELEVATIONS
R-A3.2	CABINET DETAILS
R-A4	SCHEDULES
S1.0	GENERAL NOTES
S2.0	FOUNDATION PLAN
S3.0	FOUNDATION DETAILS
S4.0	PROPOSED FRAMING PLAN OF NEW BUILDING
S4.1	DEMOLITION FRAMING PLAN FOR EXISTING BUILDING
S4.2	PROPOSED FRAMING PLAN FOR EXISTING BUILDING
S5.0	ROOF PLAN
S6.0	GENERAL FRAMING DETAILS
S6.1	GENERAL FRAMING DETAILS
MEP1.1	MEP SITE PLAN
M2.1	MECHANICAL GENERAL NOTES, LEGEND & ABBREVIATIONS
M3.1	MECHANICAL PLAN
M3.2	MECHANICAL ROOF PLAN
M4.1	MECHANICAL SCHEDULES
M5.1	MECHANICAL DETAILS
R-MD1.1	EXISTING BLDG. MECHANICAL DEMO PLAN
R-MD1.2	EXISTING BLDG. MECHANICAL ROOF DEMO PLAN
R-M3.1	EXISTING BLDG. MECHANICAL PLAN
R-M3.2	EXISTING BLDG. MECHANICAL ROOF PLAN

E2.1	ELECTRICAL SYMBOLS, LEGEND & ABBREVIATIONS
E3.1	LIGHTING FLOOR PLAN
E4.1	ELECTRICAL FLOOR PLAN
E5.1	BUILDING ADDITION ELECTRICAL RISER DIAGRAM AND SCHEDULES
E6.1	LUMINAIRE SCHEDULE, LIGHTING AND CONTROL IMAGES
E7.1	ELECTRICAL DETAILS
R-ED1.1	EXISTING BUILDING ELECTRICAL DEMOLITION PLAN
R-E3.1	EXISTING BUILDING LIGHTING PLAN
R-E3.2	EXISTING BUILDING LIGHTING PLAN – ALTERNATE #2
R-E4.1	EXISTING BUILDING ELECTRICAL PLAN
R-E4.2	EXISTING BUILDING ELECTRICAL ROOF PLAN
R-E5.1	EXISTING BUILDING ELECTRICAL RISER DIAGRAM AND SCHEDULES
P2.1	PLUMBING PLAN
P3.1	WASTE AND VENT
P4.1	PLUMBING SCHEDULES AND DETAILS
P4.2	PLUMBING DETAILS
R-PD1.1	EXISTING BUILDING PLUMBING DEMO PLAN
R-P2.1	PLUMBING PLAN
R-P3.1	WASTE AND VENT

SECTION 01010 - SUMMARY OF WORK

PART 1 - GENERAL

1.01 GENERAL CONDITIONS

As specified in Section 00700.

1.02 SUMMARY

A. Project identification:
Cameron Appraisal Building Addition – Cameron Appraisal District, San Benito, Texas -

B. Project Summary: The Project documents are provided as two separate projects for identification as separate areas of work for management of the project with complementary details and specific details. The work is considered as a single project in the bid documents. Project includes two distinct areas of work.

- Complete construction for Cameron Appraisal Building Additions including but not limited to: Site work, Concrete sidewalks, Landscaping, Gates, Fencing, Demolition, Concrete Foundation, Structural Steel frame with Bar Joists and misc steel, Single Ply Roof, Metal Canopies, Concrete Masonry Unit walls, metal stud frame walls, stucco walls, densglass sheathing, tyvek exterior spray applied damproofing, gypsum board sheathing, insulation, painting, aluminum windows, storefront glass and doors, metal and wood doors, metal frames, cabinetry, suspended acoustical ceiling, ceramic tile floors, vinyl composition tile floor, utility service installation for complex including: HVAC systems, electrical systems, telephone, fire alarm, fire sprinkler system, security, data system, water and wastewater systems
- Specific Renovations to Existing Cameron Appraisal Building including but not limited to: Site work, Concrete sidewalks, Landscaping, Gates, Fencing, Demolition, Concrete Foundation, Structural Steel frame with Bar Joists and misc steel, Asphaltic Built Up Roof Repairs, Metal Canopies, Standing Seam Metal Roof, Concrete Masonry Unit walls, metal stud frame walls, stucco walls, densglass sheathing, tyvek exterior spray applied damproofing, gypsum board sheathing, insulation, painting, aluminum windows, bulletproof glass, storefront glass and doors, metal and wood doors, metal frames, cabinetry, suspended acoustical ceiling, ceramic tile floors, vinyl composition tile floor, utility service installation for complex including: HVAC systems, electrical systems, telephone, fire alarm, fire sprinkler system, security, data system, water and wastewater systems

C. The Owner is considering performing the work of preparing and installing the security, systems. If the price from the Contractor is favorable, the Contractor shall provide this service. If the Owner performs this work the Contractor is to coordinate the installation and proper location of all site elements installed by the Owner for a successful project.

D. The Owner requires the contractor to complete the work and the facility to be open by a certain date. The contractor and his major subcontractors shall meet with the Owner and Architect to discuss, decide, and schedule the various major and minor phases of the work for secure and safe operation such that the facility will be open on time.

E. The Contractor shall provide security services as required, at the Contractor's expense during the work

F. The Contractor shall provide all safety measures as required by OSHA, the State of Texas and the City of San Benito.

G. The Contractor shall provide a chain link construction fence with secure gated entry during the course of the work.

H. The Contractor shall provide for the safe storage of items purchased by the Owner and its contractors for installation on this project for the duration of the project.

I. The Contractor shall provide for the safety of the employees and clients of the Cameron Appraisal District during construction of the work. Proper partitioning of the work areas away from the public are required and specific demolition and construction activities are to be coordinated with the CAD for the unabated use of building for the work of the CAD

END OF SECTION

SECTION 01019 - GENERAL SPECIFICATIONS

PART 1 - GENERAL

1.01 GENERAL CONDITIONS

As specified in Section 00700.

1.02 SCOPE OF WORK

Work shall consist of furnishing all labor, tools, materials and equipment necessary and required to construct in place and complete all work as indicated on the drawings and as specified herein.

1.03 GENERAL

A. Construction Lines, Levels and Grades: The Contractor shall verify all job site conditions, lines, levels and elevations indicated on the drawings before any demolition or construction begins. Any discrepancy shall be immediately brought to the attention of the Architect, and any change shall be made in accordance with his instruction. The Contractor shall not be entitled to extra payment if he fails to report the discrepancies before proceeding with any work whether within the area affected or not.

B. Coordination: The contractor shall coordinate with the Architect & the Owners Representative and any subcontractors or owners personnel which are required to work on the site. The main work that the owner is required to perform is the construction of Security, Telephone and Computer Cabling.
   1. The Contractor shall schedule delivery of all materials to be used on the project, be it from General Contract or from Owner for installation by Owner or Contractor.
   2. The delivery of materials must be coordinated through the Owner's Representative and/or Architect as to delivery dates and invoices provided on stored materials with Application for Payment before approval for payment.
   3. Materials should be stored in a temporary fenced area and, as required, in a secure temporary building protected from the weather on site, coordinate location with the Owner. If material is stored on the roof do not overload the structure.

C. Notices: The Contractor, from a previously planned schedule, shall call the Project Contact Person (as indicated in the SPECIAL PROVISIONS) and the Architect and give at least five (5) working days notice before starting the work. All Concrete pours and other related work must be observed by the Architect and/or his engineers before the work is covered. Any barricades or temporary entrance protection must be installed before the starting the work.

D. Conditions at Site: Every person bidding on this project is expected to visit the site and examine the conditions and satisfy himself as to the character and amount of the work to be performed as indicated on the drawings and called for by the specifications. No additional allowance will be granted because of the lack of knowledge of such conditions.

E. Disruption of Utility Services: All work related to the temporary disconnection of electrical systems, HVAC systems or plumbing systems shall be pre-arranged with the Owners Representative & the Architect so that any disruption of such services will be kept to a minimum. In the event temporary power hook-up is required, the Contractor shall provide the necessary services.

F. Contractor's Operations:
   1. The Contractor must employ, insofar as possible, such methods and means of carrying out his work in the time allowed so as not causing any interruption or interference to the facility's operations. Where the Contractor's operations would result in interruptions, which would hamper the operations of the facilities, the Contractor shall rearrange his schedule of work accordingly to finish on time.
   2. The Contractor shall maintain safe passageway to and from the facility's occupied rooms and other occupied spaces for the members and staff of the Owner at all times.

G. Utility Services:

   1. Telephone: The Contractor shall make arrangements for his own regular and cellular telephone service.

2. Water and Electricity:
    a. The Contractor shall make the necessary coordination with the Water Supply District for temporary connection and use of water service.
    b. The Contractor shall make the necessary coordination with the Electric Company for temporary connection and use of electricity
    c. The Contractor must make arrangements and pay for the use of water and electricity during construction of the facility until the Owner accepts & occupies building after final acceptance of punch list items unless other arrangements are made at end of project.

H. Parking Policy for Contractor:
1. The Contractor and his employees should not park on Employee Parking areas or on adjoining properties unless special arrangements are made with the owners. Delivery of materials shall be limited to the designated areas and to the time it takes to unload. Specific fenced area for unloading shall be inside a construction fenced side yard unless otherwise required.
2. Areas to be used by the Contractor shall be as designated by the Architect. After installation of the Landscaping, no parking on the lawn by any vehicles shall be done. Any lawn damaged by the Contractor shall be restored when so instructed by the Architect at no cost to the Owner.

I. Toilet Accommodations: The Contractor must provide portable toilet facilities. It is the Contractor's responsibility to keep same clean and in a sanitary condition at all times.

J. Protection of Property: The Contractor shall continually maintain adequate protection of all his work from damage and shall protect all property, including but not limited to buildings, equipment, furniture, personal effects and property of the Owner, located at and adjoining the job site. The Contractor shall repair, replace or pay the expense of repair of damages resulting from his fault or negligence.

K. Use of Power Driven Equipment: The Contractor is cautioned to take all necessary safety precautions to protect the project the public whenever power driven equipment is used.

L. Safety:
1. The Occupational Safety and Health Law for State and local municipality and requirements of OSHA in its latest amended form, is applicable and made a part of the Contract.
2. The Contractor shall carefully read and strictly comply with its requirements.

M. Clean Up of Premises: The Contractor shall clean up and remove from premises all debris accumulated from operations from time to time and as directed.

N. Responsibility:
1. The Owner will hold the Contractor liable for all the acts of Subcontractors employed under the contractor and shall deal only with them (the primary Contractors) in matters pertaining to other trades employed on the job. The Contractor shall be responsible for coordinating the work of all trades on the job under his contract.
2. Should he discover any discrepancy in the plans or specifications, the Contractor shall immediately notify the Architect before proceeding any further with the work, otherwise, he will be held responsible for any cost involved in correction of work placed due to such discrepancy.

O. Cooperation With Other Contractors: The Owner reserves the right at any time to contract for or otherwise perform other or additional work within the contract zone limits of this Contract. The Contractor for this project shall, to the extent ordered by the Owner, conduct his work so as not to interfere with or hinder the progress or completion of the work performed by other contractors.

P. Division of the Work: The Divisions and Sections into which these Specifications are divided shall not be considered an accurate or complete segregation of work by trades. This also applies to all work specified within each Section.

Q. Plans and Specifications:
1. The Contractor shall not make alterations in the drawings and specifications. In the event he discovers any errors or discrepancies, the Contractor shall immediately notify the Architect in accordance with the GENERAL CONDITIONS.
2. Where devices, or items, or parts thereof are referred to in the singular, it is intended that such reference shall apply to as many such devices, items or parts as are required to properly complete the work.

3. Specifications and drawings are prepared in abbreviated form and include incomplete sentences. Omission of words or phrases such as "the Contractor shall", "as shown on the drawings", "a", "an", and "the" are intentional. Omitted words and phrases shall be provided by inference to form complete sentences.

R. Required Submittals:
   1. Required submittals as specified in the Technical Sections of these specifications include one or more of the following: Shop drawings; color samples; material samples; technical data; schedules of materials; schedules of operations; guarantees; operating and maintenance manuals; and as-built drawings.
   2. Contractor shall make a comprehensive list of required submittals and provide a schedule of date for delivery of submittals, by Specification Section, & submit this list to the Architect within 5 days after notice to proceed.
   3. Do not install any item which requires submittals until submittals are reviewed and allowed for installation.
   4. As-Built Drawings: When as-built drawings are required for submittal, the following shall apply:
      a. As-built drawings, the intent of which is to record the actual in-place construction so that any future renovations or tie-ins can be anticipated accurately, shall be required.
      b. To accomplish this, the Contractor shall draw onto the original tracings all authorizations given by the Architect to deviate from the plans.
      c. Original tracings for this purpose shall be furnished to the Contractor by the Owner upon the written request of the former at any suitable time.
      d. All deviations from alignments, elevations and dimensions, which are stipulated on the plans, shall be recorded on the as-built drawings.
      e. The following procedure shall be followed:
         1. Immediately after these changes are constructed in place, the Contractor shall record them on the field office plans. This is to assure that changes are recorded before they are forgotten.
         2) Within two weeks after final inspection of the project, the Contractor shall transfer the changes marked on the field office plans onto the original tracings using a red pencil. Any deletions shall be eradicated from the tracings and redrawn as necessary. The Contractor shall stamp or mark the tracings "AS-BUILT", and also sign and date each drawing so marked.
         3) The Contractor shall submit the as-built drawings together with the marked-up field office plans to the Architect.
         4) Any as-built drawing, which the Architect determines does not accurately record the deviation, shall be corrected by the Owner's Representative and/or the Architect, and the Contractor shall be charged and pay for these services.

END OF SECTION

SECTION 01027 - APPLICATION FOR PAYMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Comply with procedures described in this Section when applying for progress payment and final payment under the Contract.
B. Related work:
   1. Documents affecting work of this Section include, but are not necessarily limited to, the Agreement, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
   2. The Contract Sum and the Schedule for Payments are described in the Form of Agreement.
   3. Payments upon Substantial Completion and Completion of the Work are described in the General Conditions and in Section 01700 of these Specifications.
   4. The Architect's approval of applications for progress payment and final payment may be contingent upon the Architect's approval of status of Project Record Documents.

1.2 QUALITY ASSURANCE

A. Prior to start of construction, secure the Architect's approval of the schedule of values as required to be submitted under paragraph 9.3 of the General Conditions and further described in Section 00800 of these Specifications, include separate line items for Betterment Fund, Allowances and any Change Orders applied to the work.
B. During progress of the Work, modify the schedule of values as approved by the Architect to reflect changes in the Contract Sum due to Change Orders or other modifications of the Contract.
C. Base requests for payment on the approved schedule of values.

1.3 PROCEDURES

A. Informal submittal: Unless otherwise directed by the Architect.
   1. Make an informal submittal of request for payment by filling in, with erasable pencil pertinent portions of AIA Document G702, "Application and Certificate for Payment," plus continuation sheet or sheets.
   2. Make this preliminary submittal to the Architect at the last regular job meeting of each month.
   3. Revise informal submittal of request for payment as agreed at job meeting, initialing all copies.
B. Formal submittal: Unless otherwise directed by the Architect.
   1. Make formal submittal or request for payment by filling in agreed data, by typewriter or neat lettering in ink on AIA Document G702, "Application and Certificate for Payment, plus continuation sheet or sheets.
   2. Sign and notarize the Application and Certificate for Payment.
   3. Submit the original of the Application and Certificate for Payment, plus three identical copies of the continuation sheet or sheets, to the Architect.
   4. The Architect will compare the formal submittal with the improved informal submittal and when approved, will sign the Application and Certificate for Payment, will make required copies, and will distribute:
      a. One copy to Contractor
      b. One copy to Owner; and
      c. One copy to Architect's file.

END OF SECTION

SECTION 01028 - CHANGE ORDER PROCEDURE

PART 1 - GENERAL

1.01 SUMMARY

A. Make such changes in the Work, Contract sum, Contract Time of Completion, or any combination thereof, as are described in written Change Orders signed by the Owner and Architect and issued after execution of the Contract, in accordance with the provisions of this Section.
B. Related work:
   1. Documents affecting work of this Section include, but are necessarily limited to, the Agreement, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
   2. Changes in the Work are described further in the General Conditions.
   3. Architect's supplemental instructions
      a. From time to time during progress of the Work the Architect may issue supplemental instructions which interpret the contract Documents or order minor change in Contract sum or Contract Time.
      b. Should the Contractor consider that a change in contract Sum or Contract Time is required, he shall submit an itemized proposal to the Architect immediately and before proceeding with the work. If the proposal is found to be satisfactory and in proper order, the supplemental instructions in that event will be superseded by a Change Order.
   4. Proposal requests:
      a. From time to time during progress of the Work the Architect may issue a proposal or request for an itemized quotation for changes in the Contract Sum and/ or Contract Time incidental to proposed modifications to the Contract Documents.
      b. This will not be a Change Order, and will not be a direction to proceed with the changes described therein.

1.02 QUALITY ASSURANCE

A. Include within the Contractor's quality assurance program such measures as are needed to assure familiarity of the Contractor's staff & employees with these procedures for processing Change Order data.

1.03 DELIVERY, STORAGE AND HANDLING

A. Maintain a "Register of Proposal Requests, Supplemental Instructions, and Change Orders" at the site, accurately reflecting current status of all pertinent data.
B. Make the register available to the Architect for review at his request.

1.04 PROCESSING PROPOSAL REQUESTS

A. Make written reply to the Architect in response to each proposal request.
   1. State proposed change in the Contract Sum, if any.
   2. State proposed change in the Contract Time of completion, if any.
   3. Clearly describe other changes in the Work, if any, required by the proposed change.
   4. Include full backup data such as subcontractor's letter of approval or similar information.
   5. Submit this response in single copy.
   6. Change Orders from the Betterment Fund or Allowances included in the contract shall not have profit and overhead added to the cost of the work as these costs are included in the original contract for construction.
   7. Change Orders after the Betterment Fund or Allowance items are depleted shall have a profit of 5% added to the cost of the work only.
B. When the Owner or the Contractor have agreed upon a cost or credit for the change, or the Owner has directed that cost or credit be determined in accordance with provisions of the General Conditions, the Architect will issue a Change Order to the Contractor.

1.05 PROCESSING CHANGE ORDERS

A. Change Orders will be numbered in sequence, and dated.
   1. The Change Order will describe the change or changes, will refer to the proposal requests or supplemental instructions involved, and will be signed by the Owner and the Architect.
   2. The Architect will issue three copies of each Change Order to the Contractor.
      a. The Contractor promptly shall sign all three copies and return two copies to the Architect.
      b. The Architect will retain one signed copy in his file, and will forward one signed copy to the Owner.

END OF SECTION

01100 - SPECIAL PROVISIONS

PART 1 - GENERAL

1.01 GENERAL CONDITIONS As specified in SECTION 00700.

1.02 SUBSTITUTION REQUESTS

The written substitution requests must be received by the Architect no later than 4:30 P.M. FIVE DAYS Working Days before bid opening. Substitution requests by Email are acceptable.

1.03

PROJECT CONTACT PERSON	(Owner)
NAME:	Mr. Richard Molina
POSITION OR TITLE:	Chief Appraiser
TELEPHONE NUMBER:	(956) 399-9322
PROJECT CONTACT PERSON	(Architect)
NAME:	Mr. Stanford C. Knowles, AIA
POSITION OR TITLE:	Architect
TELEPHONE NUMBER:	(956) 233-2218
EMAIL:	knowlesaia@aol.com

1.04 ASBESTOS PROHIBITION

In case there are discrepancies incorporated in any section of the technical specifications and/or the General Conditions of the contract, the following shall prevail:

Asbestos Prohibition: No asbestos containing materials or equipment shall be used under this section. The Contractor shall ensure that all materials and equipment incorporated in the project are asbestos free.

1.05 SUBCONTRACTING

A. The Contractor shall perform with his own organization.
   1. The Contractor who is the apparent best qualified proposer shall, within five working days after notice to negotiate, submit to the Architect copies of all subcontract bids and items and/or per unit bids. If a subcontract bid includes both specialty items and non-specialty items, the amounts for each category shall be noted. Award of the contract shall not be made until the Architect has confirmed the requirement of the preceding paragraph.
   2. If the apparent best qualified proposer fails to submit copies of all subcontract bids and items and/or per unit bids within the five working days after the notice, his proposal will be rejected and the next apparent best qualified proposer will be allowed two working days to submit copies of all their subcontract bids as described above.

END OF SECTION

SECTION 01150 – BETTERMENT FUND

PART 1 – GENERAL

1.01 DESCRIPTION:

A. The project may have various items, which may be outside of the contract documents, or Intent of the project or which may be uncovered during the process of construction which is not covered in these documents.

B. The General Contractor shall add $40,000.00 to the contract bid as a Betterment Fund which, if not used, shall be deducted and not be paid to the contractor at the final Application for Payment on the project.

C. If there is a need for funds for additional work at the request of the Owner, as items are uncovered which are not in the description of the work, or at the request of the Architect and approved by the Owner; the contractor on application for a Change Order, shall first apply this Betterment Fund to the work as instructed by the Architect. Any additional funds shall be applied for in a second Change Order request.

D. The cost of any such work shall be cost of the labor and materials only. If the Betterment Funds are depleted, subsequent Change Orders shall be the cost of the labor and materials plus 5%. Such cost must be approved in writing before attempting to do the work. If the work is done without such approvals the Owner has the option to accept or reject the work at no extra cost to the Owner.

E. The Betterment Fund amount of $40,000.00 shall be expressed as part of the Application for Payment as a line item on the Continuation Sheet and transferred to a descriptive Change Order if and when required and as approved by the Owner. If not used, the balance in the Betterment Fund shall show as a credit to the owner on the final Application for Payment.

F. Also include Allowances noted on Civil, MEP and Structural Plans and Specifications if any.

G. Each Amount shall have a separate line item in the Application for Payment

END OF SECTION

SECTION 01231 – SELECTION CRITERIA

PART 1 - GENERAL

A. The Owner has set forth the following selection criteria. An evaluation committee shall accept submitted sealed proposals. The committee will evaluate, rank, and publish said ranking once this has been completed. The evaluation criteria are that which the evaluation committee, as outlined below, has approved to assess the best value for the Owner. The evaluation committee will then proceed to negotiate a contract with the highest-ranking offeror (General Contractor). The Owner and the Architect may discuss with the selected offeror options for a scope or time modification and any price change associated with the modification. If the Owner is unable to negotiate a contract with the selected offeror, the Owner shall, formally and in writing, end negotiations with that offeror and proceed to negotiate with the next highest offeror. The Owner reserves the right to exclude firms failing to achieve a minimum total score from any further consideration for negotiation. Upon negotiation of a successful contract the committee will present such evidence of finding to the Board, which will retain the right to award or reject all Proposals in their entirety.

B. In determining the best value for the Owner, the Owner is not restricted to considering price alone, but may consider any other factor stated in the selection criteria.

C. The Offeror shall provide any information with relevant attachments related to the Selection Criteria below along with the proposal documents on the proposal date for consideration by the evaluation committee. **IF THE OFFERER PROVIDES NO INFORMATION FOR CONSIDERATION OF A CRITERIA CATEGORY ITEM, THE OFFERER WILL RECEIVE ZERO (0) POINTS FOR THAT ITEM. Please provide information requested.**

D. Selection Criteria

The Owner retains the right to apply all criteria as appropriate and allowed by the State of Texas Government Code. To include the following:

1. Proposal Amounts for:
    a. Base Bid Proposal
    b. Alternate Bid Proposals, if any.

2. Value Engineering (material improvement and/or cost reductions) Proposal (submit in sealed envelope attached to proposal) including the extent to which the goods and services meet the Owner's needs.

3. Past Performance with Public Entities and Office Projects in particular

4. Safety Record

5. Methodology for Construction of the Project

6. Proposed Personnel and Experience of Personnel

7. Time Schedule for Construction

8. Other relevant factors that a private business entity would consider in selecting a General Contractor

PART 2 - RANKING CRITERIA FOR SELECTION OF BUILDING CONTRACTORS

Project Name: _____ Contractor: _____

Project Locations(s): _____Bid/Proposal: _____

Ranking Date: _____ Bid Opening Date: _____

Category	Sub- Categories Good	Average	Poor	Rating Points
1. PRICE				40 Maximum Pts
a. Construction Cost	_____	_____	_____	30 pts
b. Value Engineering	_____	_____	_____	5 pts
c. Number Of Working Days	_____	_____	_____	5 pts
2. CONSTRUCTION EXPERIENCE				16 Maximum Pts
a. Experience With Local Governmental Projects	_____	_____	_____	4 pts
b. Experience With Cameron Appraisal District	_____	_____	_____	4 pts
c. Comparability Of Working w/ Similar Size, Type & Complexity Of Project	_____	_____	_____	4 pts
d. Personnel & Job Superintendent Qualifications	_____	_____	_____	4pts
3. PAST AND CURRENT JOB PERFORMANCE				24 Maximum Pts
a. Quality Of Work	_____	_____	_____	4 pts
b. Warranty Documents And Follow Up	_____	_____	_____	3 pts
c. Completion Of Punchlist Items & Close Out Documents	_____	_____	_____	3 pts
d. Payment Of Bills	_____	_____	_____	3 pts
e. Meeting Of Timelines	_____	_____	_____	3 pts
f. Change Order Prices	_____	_____	_____	4 pts
g. List Of Subcontractors Quality and Reputation	_____	_____	_____	4 pts
4. FINANCIAL STRENGTH				12 Maximum Pts
a. Letter Of References – Bank (s) Bonding Capacity	_____	_____	_____	4 pts
b. Letter Of Reference – 3 Main Suppliers And/Or Subcontractors	_____	_____	_____	4 pt
c. Performance of Bonding Company-Treasury Listing	_____	_____	_____	4 pts
5. REPUTATION				12 Maximum Pts
a. Longevity – Presence In The Valley	_____	_____	_____	4 pts
b. Contractor/Client Relationship	_____	_____	_____	4 pts
c. Professionalism – With Past And Current Clients And Other Agents	_____	_____	_____	4 pts
TOTAL POINTS SCORED				_____

END OF SECTION

SECTION 01300 - ADMINISTRATIVE REQUIREMENTS

PART 1 - GENERAL

1.01 PROJECT MANAGEMENT AND COORDINATION

A. Verify layout information shown on Drawings, in relation to property survey and existing benchmarks, before laying out the work.

B. Progress meetings will be held at Project site every other week. Owner, Architect, Contractor, and each subcontractor or other entity concerned with current progress or involved with planning or coordination of future activities shall attend.

1. Minutes of each meeting will be prepared by Contractor, with action items described and addressed to the person or entity required to perform the work, and distributed to all parties present, including but not limited to Owners representative, Architect and Contractor.

1.02 CONSTRUCTION SCHEDULE

A. Prepare a horizontal bar-chart-type, construction schedule with Phases of Work. Provide a separate time bar for each activity and a vertical line to identify the first workday of each week. Use same breakdown of Work, indicated in the Schedule of Values. As Work progresses, mark each bar to indicate actual completion time.

1. Submit within 10 days of the date established for Commencement of the work.
2. Prepare the schedule on reproducible media, of width sufficient to show data for entire construction period.
3. Coordinate each element with other activities. Show each activity in proper sequence. Indicate sequences necessary for completion of related work.
4. Indicate Substantial Completion and allow time for Architect's procedures necessary for certifying Substantial Completion.
5. Schedule Distribution: Distribute copies to Owner, Architect, subcontractors, and parties required to comply with dates.
6. Updating: Revise the schedule after each meeting or activity where revisions have been made

1.03 SUBMITTAL PROCEDURES

A. Coordinate submittal preparation with construction schedule, fabrication lead-times, other submittals, and other activities that require sequential operations.

1. No extension of Contract Time will be authorized due to failure to transmit submittals in time to permit processing sufficiently in advance of when materials are required in the work.
2. Architect will not accept submittals from sources other than Contractor.

B. Prepare submittals by placing a permanent label on each for identification. Provide a 4- by 5-inch space on the label or beside title block to record review and approval markings and action taken.

Include the following information on the label:

1. Project name.
2. Date.
3. Name and address of Contractor.
4. Name and address of subcontractor and supplier.
5. Number and title of appropriate Specification Section.

6. Contractor's certification that materials comply with specified requirements.

C. Product data: Mark each copy to show applicable choices and options. Include the following:
   1. Data indicating compliance with specified standards and requirements.
   2. Notation of coordination requirements.
   3. For equipment data, include rated capacities, dimensions, weights, required clearances, and furnished specialties and accessories.

D. Shop Drawings: Submit newly prepared information drawn to scale. Indicate deviations from Contract Documents. Do not reproduce or copy standard information. Submit 1 reproducible print and 1 blue- or black-line print on sheets at least 8 1/2 by 11 inches but no larger than 24 by 36 inches. Architect will return the reproducible print. Include the following:
   1. Dimensions, profiles, methods of attachment, coordination with adjoining work, large-scale details, and other information. As appropriate for the work.
   2. Identification of products and materials.
   3. Notation of coordination requirements.
   4. Notation of dimensions established by field measurement.

E. Samples: submit Samples finished as specified and identical with the material proposed. Where variations are inherent in the material, submit at least 3 units that show limits of the variations. Include product name or the name of the manufacturer.

F. Architect will review each submittal, mark as appropriate to indicate action taken, and return copies less those retained. Compliance with specified requirements remains Contractor's responsibility.

END OF SECTION

SECTION 01301 – SUBMITTALS, PRODUCTS AND SUBSTITUTIONS

PART 1 - GENERAL

1.01 GENERAL CONDITIONS

A. Comply with project for submittals.

B. Provide types of submittals listed in individual sections and number of copies required.
   1. Project schedule
   2. Shop Drawings, reviewed and annotated by the contractor – sepia and (if available) autocad file, and five blueline prints.
   3. Product Data – 5 copies
   4. Samples – 3, plus extra samples as required indicating range of color, finish and texture to be expected.
   5. Warranties – 4 copies.

C. Samples and shop drawings shall be prepared specifically for indicate range of color, finish and texture to be expected.

D. Provide products selected for Architect approved substitution. Products submitted for substitution shall be submitted with acceptable documentation, which provides information to verify the product is a substitution, which meets or exceeds requirements of the project, and include cost of substitution including related work or charges on the work to facilitate the substitution.

END OF SECTION

SECTION 01320 – CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

A. Submittals: Submit the following:
   1. Submittals Schedule: Submit 5 copies of schedule. Arrange the following information in a tabular format:
      a. Scheduled date for first submittal.
      b. Specification Section number and title.
      c. Submittal category (action or informational).
      d. Name of subcontractor.
      e. Description of the Work covered.
      f. Scheduled date for Architect's final release or approval.

   2. Contractor's Construction Schedule: Submit 5 printed copies of initial schedule, one a reproducible print and one a blue- or black – line print, large enough to show entire schedule for entire construction period. Revise as required during construction each month if necessary to describe changes in the schedule. Submit changes in schedule with Application for Payment.
   3. Field Condition Reports: Submit two copies at time of discovery of differing conditions.

B. Coordination: Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
   1. Secure time commitments for performing critical elements of the Work from parties involved.
   2. Coordinate each construction activity with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

A. Submittals Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, re-submittal, ordering, manufacturing, fabrication, and delivery when establishing dates.
   1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
   2. Submit concurrently with the first complete submittal of Contractor's Construction Schedule.

B. Contractor's Construction Schedule: Submit a comprehensive, fully developed, horizontal Barr-chart- type, Contractor's Construction Schedule within 10 days of date established for commencement of the Work.
   1. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
      a. For construction activities that require 3 months or longer to complete; indicate an estimated completion percentage in 10 percent increments within time bar.
   2. Time Frame: Extend schedule from date of contract award to substantial completion and award of Certificate of Occupancy from Town of Rancho Viejo.
      a. Activity Duration: Define activities so no activity is longer than 30 days, unless specifically allowed by Architect.
      b. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule.

Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

c. Submittal Review Time: Include review and re-submittal times indicated in Division 1 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
d. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.

3. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
   a. Work Stages: Indicate important stages of construction for each major portion of the Work.
4. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice of Proceed, Substantial Completion, and Final Completion.

C. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare a detailed report. Submit with a request for information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 - EXECUTION

A. Contractor's Construction Schedule Updating: At 14 day intervals, update schedule to reflect actual construction progress and activities. Issue schedule at each regularly scheduled progress meeting.
   1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
   2. As the Work progresses, indicate Actual Completion percentage for each activity.
   3. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
      a. Post copies in Project meeting rooms and temporary field offices.
      b. When revisions are made, distribute updated schedules to the same parties and post in the same locations.

END OF SECTION

SECTION 01330 – SUBMITTAL PROCEDURES

PART 1 - GENERAL

A. Definitions: As follows:
   1. Action Submittals: Written and graphic information that requires Architect's responsive action.
   2. Informational Submittals: Written information that does not require Architect's approval. Submittals may be rejected for not complying with requirements.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
   1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
   2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
      a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Submittals Schedule: Comply with requirements in Division I Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.

D. Processing Time: Allow enough time for submittal review, including time for re-submittals, as follows. Time for review shall commence on Architect's receipt of submittal.
   1. Initial Review: Allow 7 calendar days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
   2. Allow 7 calendar days for processing each re-submittal.
   3. Each submittal must have identification as outlined below:
      a. Project name.
      b. Date.
      c. Name and address of Architect.
      d. Name and address of Contractor.
      e. Name and address of subcontractor.
      f. Name and address of supplier.
      g. Name of manufacturer.
      h. Unique identifier, including revision number.
      i. Number and title of appropriate Specification Section.
      j. Drawing number and detail references, as appropriate.
      k. Other necessary identification.

E. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.

F. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions of the Contract Documents, initial submittal may serve as final submittal.
   1. Additional copies submitted for maintenance manuals will be marked with action taken and returned.

G. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will not accept submittals from sources other than Contractor.

H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, and installers, authorities having jurisdiction, and others as necessary for performance of construction activities.

Show distribution on transmittal forms.

I. Use for Construction: Use only final submittals with mark indicating action taken by Architect in connection with construction.

PART 2 - PRODUCTS

A. Action Submittals: Prepare and submit Action Submittals required by individual Specification Sections.
   1. Number of Copies: Submit 5 copies of each submittal, unless otherwise indicated. Architect will return 1 copy and Mark up and retain one returned copy as a Project Record Document.
   2. Project Data: Collect information into a single submittal for each element of construction and type of product or equipment.
      a. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
      b. Mark each copy of each submittal to show which products and options are applicable.
      c. Include the following information, as applicable:
         1. Manufacturer's written recommendations.
         2. Manufacturer's product specifications.
         3. Manufacturer's installation instructions.
         4. Manufacturer's catalog cuts.
         5. Wiring diagrams showing factory-installed wiring.
         6. Printed performance curves.
         7. Operational range diagrams.
         8. Compliance with recognized trade association standards.
         9. Compliance with recognized testing agency standards.

   3. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable.
      a. Dimensions.
      b. Identification of products.
      c. Fabrication and installation drawings.
      d. Roughing-in and setting diagrams.
      e. Shop work manufacturing instructions.
      f. Templates and patterns.
      g. Schedules.
      h. Notation of coordination requirements.
      i. Notation of dimensions established by field measurement.
      j. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
      k. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 40 inches.

   4. Samples: Prepare physical units of materials or products, including the following:
      a. Comply with requirements in Division 1 Section "Quality Requirements" for mockups.
      b. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
      c. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from the same material to be used for the Work, cured & finished in manner specified, physically identical with the product proposed for use, and that show full range of color and texture variations expected.
      d. Preparation: Mount, display, or package Samples in manner specified to facilitate review of qualities indicated. Prepare Samples to match Architect's sample where so indicated. Attach label on unexposed side.

e. Submit Samples for review of kind, color, pattern, and texture for a final check of these characteristics with other elements and for a comparison of these characteristics between final submittal and actual component as delivered and installed.
f. Number of Samples for initial Selection: Submit (one) full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
g. Number of samples for Verification: Submit one set of samples. Architect will maintain sample for duration of project.
h. Deposition: Maintain sets of approved samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

5. Product Schedule or List: Prepare a written summary indicating types of products required for the work and their intended location.
6. Delegated-Design Submittal: Comply with requirements in Division 1 Section "Quality Requirements"
7. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation"
8. Schedule of Values: Comply with requirements in Division 1 Section "Payment Procedures"
10. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design.

B. Information Submittals: Prepare and submit Information Submittals required by other Specification Section.
1. Number of Copies: Submit 5 copies of each submittal, unless otherwise indicated. Architect will not return copies.
2. Certificates & certifications: Provide a notarized statement that includes signature of Contractor, testing agency, or design professional responsible for preparing certification. An officer shall sign certificates and certifications or other individual authorized to sign documents on behalf of the company.
3. Test and Inspection Reports: Comply with requirements in Division 1 Section "Quality Requirements"
4. Contractor's Construction Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation"
5. Qualification data: Prepare written Information that demonstrates capabilities and experience of firm or person. Include list of completed projects with project names and addresses of architects and owners, and other information specified.
6. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements.
7. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specifications (WPS) and Procedure Qualification Record (PQR) on AWS form. Include manes of firms and personnel certified.
8. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements and, where required, is authorized for this specific Project.
9. Manufacturer Certificate: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements. Included evidence of manufacturing experience as required.
10. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.
11. Material test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.
12. Field Test Reports: Prepare Reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements.
13. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

END OF SECTION

SECTION 01400 – QUALITY REQUIREMENTS

1.1 GENERAL

A. Testing and inspecting service are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Documents requirements.
   1. Quality-control services do not include contract enforcement activities performed by Architect.

B. Delegated-Design Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
   1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to architect.

C. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and system are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing.
   1. Areas of concern are Texas Windstorm Tier 1 requirements for Doors, Windows and Roof as well as structural elements

D. Reports: Prepare and submit certified written reports that include the following:
   1. Date of issue
   2. Project title and number
   3. Name, address, and telephone number of testing agency
   4. Dates and locations of samples and test or inspections
   5. Names of individuals making test and inspections
   6. Description of the Work and test and inspection method
   7. Identification of product and specification Section
   8. Complete test or inspection data
   9. Test and inspection results and an interpretation of test result
   10. Ambient conditions at time of sample taking and testing and inspecting
   11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
   12. Name and signature of laboratory inspector
   13. Recommendations on testing and re-inspecting

E. Permits, Licenses and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, release, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

F. Fabricator Qualifications: A Firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

G. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacture who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this project.

H. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

I. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance.

J. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

K. Testing Agency Qualifications: An agency with experience and capability to conduct testing and inspecting indicated, as documented by ASTM E 548, and that specializes in types of tests and inspections to be performed.

L. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
   1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a disruption of the types of testing and inspecting they are engaged to perform.
   2. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

M. Contractor Responsibilities: Unless otherwise indicated, provide quality-control services specified and required by authorities having jurisdiction.
   1. Where services are indicated as Contractor's responsibilities, engage a qualified testing agency to perform these quality-control services.
      a. Contractor shall not employ the same entity engaged by Owner, unless agreed to in writing by Owner.
   2. Notify testing agencies at least 48 hours in advance of time when Work that requires testing or inspecting will be performed.
   3. Where quality-control services are indicated as Contract's responsibility, submit a certified written report, in duplicate, of each quality-control service.
   4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
   5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

N. Special Tests and Inspection: Owner will engage a testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner.
   1. Testing agency will notify Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of is services.
   2. Testing agency will submit a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction within five (5) days of test, inspection or similar quality control service.
   3. Testing agency will submit a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
   4. Testing agency will interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
   5. Testing agency will retest and re-inspect corrected work.

O. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing.

P. Re-testing/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality services, including re-testing and re-inspecting, for construction that revised or replaced Work that failed to comply with requirements established by the Contract Documents.

Q. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
   1. Notify Architect and Contractors immediately of irregularities or deficiencies observed in the Work during performance of its services by phone on the day of observance.
   2. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements
   3. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor to be delivered with five (5) days of such inspection or test.
   4. Do not release, revoke, alter, or increase requirements of Contract Documents or approve or accept any portion of the Work.
   5. Do not perform any duties of Contractor.

R. Associated Services: Cooperate with agencies performing required test, inspections, and similar quality-control services, and provide reasonable auxiliary services requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
   1. Access to the Work
   2. Incidental labor and facilities necessary to facilitate test and inspections.
   3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
   4. Facilities for storage and field-curing of test samples
   5. Delivery of samples to testing agencies
   6. Preliminary design mix proposed for use for materials mixes that require control testing agency.
   7. Security and protection for samples and for testing and inspecting equipment at Project site.

S. Coordination: Coordination sequence of activation to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting

1.2 EXECUTION

A. Repair and Protection: On completing of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrate and finishes.
   1. Provide materials and comply with installation requirements specified in other Sections of these Specifications. Restore patched areas and extend restoration into adjoining areas in a manner that eliminate evidence of patching.
   2. Protect construction exposed by or for quality –control service activities.
   3. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

SECTION 01410 - TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections apply to work specified in this Section.

1.2 PROCEDURE

A. Owner's Testing Laboratory:

An independent testing laboratory will be selected and furnished by the Owner to inspect and test the materials and methods of construction as hereinafter specified for compliance with the specification requirements of the Contract Documents and to perform such other specialized technical services as required by the Owner or his representative. All testing lab services shall be paid for by the owner.

1.3 QUALIFICATIONS OF TESTING LABORATORY

A. The Testing Laboratory selected shall meet the basic requirements of ASTM E329 "Standard of Recommended Practice for Inspection and Testing Agencies for Concrete and Steel as Used in Construction", and shall submit to the Contractor, Owner, Architect, and Engineer, a copy of the report of inspection of their facilities made by the Materials Reference Laboratory of the National Bureau of Standards during the most recent tour of such inspections, and shall submit a memorandum stating steps taken to remedy all deficiencies reported by this inspection.

B. The Testing Laboratory selected shall meet "Recommended Requirements for Independent Laboratory Qualification", latest edition, as published by the American Council of Independent Laboratories.

C. The Testing Laboratory shall be approved by the Building Official of the City of San Antonio, Texas to perform inspection and certification services as an approved inspector of prefabricated construction.

D. Testing machines shall be calibrated at intervals not exceeding 12 months by devices of accuracy traceable to the National Bureau of Standards or accepted values of natural physical constants. The Testing Laboratory shall submit a copy of certificate of calibration made by an accredited calibration agency.

E. Tests and inspections shall be conducted in accordance with specified requirements, and if not specified, in accordance with the applicable standards of the American Society for Testing and Materials or other recognized and accepted authorities in the field.

1.4 AUTHORITIES AND DUTIES OF THE LABORATORY

A. Attending Preconstruction Conferences: The Owner's Testing Laboratory shall obtain and review the project plans and specifications with the Architect and Engineer as soon as possible prior to the start of construction. The Owner’s Laboratory shall attend preconstruction conferences with the Architect, Engineer, Project Manager, General Contractor, and Material Suppliers as required to coordinate materials inspection and testing requirements with the planned construction schedule. The Owner's Laboratory will participate in such conferences throughout the course of the project.

B. Outline Testing Program: The Owner's Testing Laboratory shall be responsible for outlining a written detailed testing program conforming to the requirements as specified in the Contract Documents and in consultation with the Owner, Contractor, Architect, and Engineer. The testing program shall contain an outline of inspections and tests to be performed with reference to applicable sections of the specifications or drawings and a list of personnel assigned to each portion of the work. Such testing program shall be submitted to the Owner, Contractor, Architect, and Engineer five weeks in advance of the start of construction so as not to delay the start of construction. It shall be the Testing Laboratory's responsibility that such program conforms to the requirements of the Specifications and drawings and falls within the budget for testing laboratory services. If the allocated budget is not sufficient to cover the services as outlined

in the Specifications, it shall be the responsibility of the Laboratory to notify the Contractor, Architect, Engineer, and Owner so that the Laboratory services can be modified accordingly prior to the start of construction. Furthermore, the Testing Laboratory shall monitor its expenditures throughout the course of the job and notify immediately the Owner, Contractor, Architect, and Engineer, of any significant deviation from the planned testing program and budget.

C. Cost Proposal: The Testing Laboratory's proposal to the Owner shall contain the outlined testing program based on a unit price basis for tests and inspections and on an hourly basis for personnel. A total estimated price shall also be submitted.

D. Cooperation with Design Team: The Laboratory shall cooperate with the Architect, Engineer, and Contractor and provide qualified personnel promptly on notice.

E. The Laboratory shall perform the required inspections, sampling, and testing of materials as specified under each section and observe methods of construction for compliance with the requirements of the Contract Documents.

F. Inspections Required by Government Agencies: The Testing Laboratory shall perform all inspections and submit all reports and certifications as required by all government agencies.

G. Notification of Deficiencies in the Work: The Laboratory shall notify the Architect, Engineer, and Contractor first by telephone and then in writing of observed irregularities and deficiencies of the work and other conditions not in compliance with the requirements of the Contract Documents.

H. Reports:

1. Information on Reports: The Laboratory shall submit copies of all reports of inspections and tests promptly and directly to the parties named below. All reports shall contain at least the following information:
   a. Project Name
   b. Date report issued
   c. Testing Laboratory name and address
   d. Name and signature of inspector
   e. Date of inspection and sampling
   f. Date of test
   g. Identification of product and Specification section
   h. Location in the project
   i. Identification of inspection or test
   j. Record of weather conditions and temperature (if applicable)
   k. Results of test regarding compliance with Contract Documents.

2. Copies: The Laboratory shall send certified copies of test and inspection reports to the following parties:
   a. 2 copies to the Owner or his representative
   b. 2 copies to the General Contractor
   c. 1 copy to the Architect
   d. 1 copy to the Engineer of responsibility
   e. 1 copy to the Supplier of the material tested
   f. 1 copy to the Mechanical Engineer

3. Certification by Notary Public:
   Upon completion of the job, the Testing Laboratory shall furnish to the Owner, Architect, and Engineer of responsibility, a statement certified by a Notary Public that all required tests and inspections were made in accordance with the requirements of the Contract Documents.

I. Accounting: The Testing Laboratory shall be responsible for separating and billing costs attributed to the Owner and cost attributed to the Contractor.

J. Obtaining Product and Material Certifications: The Testing Laboratory shall be responsible for obtaining all product and material certifications from manufacturers and suppliers as specified in the Specifications.

K. Limitations of Authority: The Testing Laboratory is not authorized to revoke, alter, relax, enlarge upon, or release any requirements of the Specifications or to approve or accept any portion of the work or to perform any duties of the General Contractor and his Subcontractors.

1.5 CONTRACTORS RESPONSIBILITY

A. Cooperation with Design Team: The owner shall pay for all testing lab services. The Contractor shall cooperate with laboratory personnel, provide access to the work, and to manufacturers operations.

B. Furnishing Samples: The Contractor shall provide to the laboratory representative, samples of materials proposed for use in the work in quantities sufficient for accurate testing as specified.

C. Furnishing Casual Labor, Equipment and Facilities: The Contractor shall furnish casual labor, equipment, and facilities as required for sampling and testing by the Laboratory and otherwise facilitate all required inspections and tests.

D. Advance Notice: The Contractor shall be responsible for notifying the Testing Laboratory sufficiently in advance of operations to allow for assignment of personnel and scheduling of tests.

E. Payment for Substitution Testing: The Contractor shall arrange with the Testing Laboratory and pay for any additional samples and tests above those required by the Contract Documents as requested by the Contractor for his convenience in performing the work.

F. Payment for Retesting: The Contractor shall pay for any additional inspections, sampling, testing, and retesting as required when initial tests indicate work does not comply with the requirements of the Contract Documents.

G. Payment by Contractor: The Contractor shall furnish and pay for the following items:

1. Soil survey of the locations of borrow soil materials, samples of existing soil materials, and delivery to the Testing Laboratory.

2. Samples of concrete aggregates and delivery to the Testing Laboratory.

3. Concrete mix designs as prepared by his concrete supplier or by his Testing Laboratory.

4. Concrete coring, tests of below strength concrete, and load tests, if ordered by the Owner, Architect, or Engineer.

5. Certification of reinforcing steel and prestressing steel mill order.

6. Certification of structural steel mill order.

7. Certification of Portland cement, lime, and flyash.

8. Certification of welders.

9. Tests, samples and mock-ups of substitute material where the substitution is requested by the Contractor and the tests are necessary in the opinion of the Owner, Architect, or Engineer to establish equality with specified items.

10. Any other tests when such cost are required by the Contract Documents to be paid by the Contractor.

H. Notification of Source Change: The Contractor shall be responsible for notifying the Owner, Architect, Engineer, and Testing Laboratory when the source of any material is changed after the original tests or inspections have been made.

I. Tests for Suspected Deficient Work: If in the opinion of the Owner, Architect, or Engineer any of the work of the Contractor is not satisfactory, the Contractor shall make all tests that the Owner, Architect, or Engineer deem advisable to determine its proper construction. The owner shall pay all costs if the tests prove the questioned work to be satisfactory.

1.6 PAYMENT OF TESTING LABORATORY

The Owner will pay for all Laboratory services for testing of materials for compliance with the requirements of the Contract Documents. The Contractor will pay for testing and retesting of materials that do not comply with the requirements of the Contract Documents and all other items as specified in these Specifications.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCOPE OF WORK

The work to be performed by the Testing Laboratory shall be as specified in this Section of the Specification and the contract drawings, and as determined in meetings with the Contractor, Owner, Architect, and Engineer.

3.2 EARTHWORK

A. Tests of Proposed Fill Material: The Testing Laboratory shall conduct a survey of the Contractor's proposed location of borrow soil materials and shall establish the suitability of any proposed fill material by determining the required engineering properties. Soil tests shall include soil classification by the Atterberg Limit Tests ASTM D4138, and grain size determined by ASTM D422 "Particle Size Analysis of Soils."

B. Moisture Density Relationship for Natural and Fill Materials: The Testing Laboratory shall provide one optimum moisture density curve for each type of soil, natural, imported fill, or on-site fill, encountered in subgrade and fills under building slabs and paved areas. Curves shall be generated in accordance with ASTM D1557 "Test Methods for Moisture Density Relationships of Soils and Soil Aggregate Mixtures."

C. Quality Control Testing Required During Construction:

1. Inspection of Subgrade and Fill:

The Owner's Testing Laboratory shall inspect and approve the following subgrades and fill layers before further construction work is performed thereon:

a. Paved Areas and Building Slab Subgrade: Make at least one field density test of the natural subgrade for every 2500 square feet of paved area or building slab but in no case less than three tests. In each compacted fill layer or lift, make one field density test for every 2500 square feet of building slab on paved area but in no case less than three tests.

2. Field Density Tests: Field Density Tests shall be run according to ASTM D1556 "Density of Soil in Place by the Sand Cone Method," ASTM D2167 "Density of Soil in Place by the Rubber Balloon Method" or ASTM D2922 "Density of Soil and Soil Aggregate in Place by Nuclear Methods" or ASTM D698 "Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort" as applicable.

3. Acceptance Criteria: The result of field density tests by the Owner's Testing Laboratory will be considered satisfactory if the average of any three consecutive tests has a value not greater than 2 percent below the required density.

4. Report Copies: The Testing Laboratory shall submit all moisture density curves and results of field density tests to the parties specified earlier in this section.

5. Additional Testing: If reports by the Owner's Testing Laboratory indicate field densities lower than specified above, additional tests will be run by the Owner's Testing Laboratory with at least the frequencies scheduled above on recompacted fill and/or natural subgrade. The Testing Laboratory shall notify the Contractor on a timely basis for any required retesting so as not to delay the work. The costs of such tests shall be borne by the Contractor.

D. Inspections by the Geotechnical Engineer: The Geotechnical Engineer shall provide inspection service of the following items prior to pouring and placing foundation concrete.
1. Mat Subgrade

3.3 REINFORCING STEEL

A. Visual Inspection: The Testing Laboratory shall inspect the rebar to determine the following:
1. The bars shall be free from injurious defects and shall have a workman-like finish.

2. Deformations shall be of the proper sizes, shapes, and spacing as detailed in ASTM A-615.

3. The bars shall not have excessive rust and/or pelting.

4. The bars shall not have any unusual twists or bends.

B. Identified Stock: Where job material is taken from bundles as delivered from the mill, is properly identified as to heat number and is accompanied by mill and analysis test reports, provided an affidavit is given from the Supplier to the Testing Laboratory that the materials conform with the requirements of the ASTM specification as listed on the structural drawings. In case of controversy, the procedure as stipulated below for unidentified stock shall be followed.

C. Unidentified Stock: For all unidentified stock, the Testing Laboratory shall secure samples of the reinforcing steel bars at the time of inspection. The samples shall confirm to the following:
1. The sample shall include 2 bars for each ten tons or fraction thereof, of each bar size, heat number, and manufacturer being shipped.

2. The sample bars shall be a minimum of 24 inches in length and should be identical to the material being shipped.

The Testing Laboratory shall tag each of the steel bundles with the Laboratory identification tag and appropriately mark the samples corresponding to the steel being inspected and shipped. The fabricator will supply shipping lists showing the weight of each bar size in the shipment. The sample reinforcing bars shall be returned to the Testing Laboratory for tensile strength tests and bend tests according to AEM A615. Bend tests will not e required for #14 and #18 bars.

3.4 CONCRETE MATERIALS AND POURED IN PLACE CONCRETE

A. Tests of Portland Cement: Portland Cement shall be tested by the Testing Laboratory for compliance with the requirements of ASTM C150.
1. Mill Certificates:
Mill certificates certifying that the cement has been tested and meets the requirements of the Specifications will be acceptable as test results, provided the cement proposed for use can be identified with test lots. Mill certificates shall be submitted by the Contractor prior to use of any such material.

2. Retesting: Retesting of cement will be required if:
a. In the opinion of the Owner, Architect, or Engineer, the cement has been damaged in storage or transit or is any way defective.

b. The cement has been in storage at the mixing site for over 30 days.

3. Cube Tests: Compressive strength cube specimens shall be made by the Contractor's Testing Laboratory at the start of the job and at a frequency of one set per 250 tons of cement or whenever the source or brand of cement changes so that the quality of cement can be observe throughout the project. Each set of 2 inch cubes shall consist of four cubes tested according to ASTM C109 at 28 day strengthens.

B. Test of Aggregates:

1. The Contractor's Testing Laboratory shall verify that concrete aggregates proposed for use conform to one of the following specifications:
   a. ASTM C33 "Specification for Concrete Aggregates"
   b. ASTM C330 "Specification for Lightweight Aggregates for Structural Concrete"

2. Tests of aggregates by the Contractor's Testing Laboratory shall be made before the concrete mix is established and hereafter as the character of the aggregate changes and whenever the service of materials is changed. The following tests will be required:
   a. Sampling: The Contractor's Testing Laboratory shall secure samples of aggregate in accordance with ASTM D75 from the concrete Supplier. The proposed aggregate shall not be used until the source has been approved by the Laboratory and the plant capacity and ability to produce uniform products has been verified.
   b. Sieve analysis: ASTM C136
   c. Organic impurities: ASTM C40
   d. Soundness: ASTM C88
   e. Abrasion of Concrete Aggregate: ASTM C131
   f. Specific gravity: ASTM C127 (coarse aggregate), ASTM C128 (fine aggregate)
   g. Deleterious materials: ASTM C33
   h. Materials Passing No. 200 Sieve: ASTM C177

   Suppliers record of such tests run on the proposed materials will be adequate provided a written affidavit is furnished as a shop drawing submittal.

C. Concrete Mix Designs: The Contractor shall submit for approval by the Engineer and Owner's Testing Laboratory at least 15 days prior to the start of construction, concrete mix designs for each class of concrete indicated on the structural drawings and in the Specifications. The Contractor shall not begin work until the applicable mix design has been approved.

1. The Contractor acting in conjunction with his Concrete Supplier and the Testing Laboratory shall submit in writing with his mix designs, whether the concrete is to be proportioned by either of the following methods as outlined in ACI 318:
   a. Field Experience Method
   b. Laboratory Trial Batch Method

   When field experience methods are used to select concrete proportions, establish proportions as specified in ACI 301 and ACI 211. When Laboratory trial batches are used to select concrete proportions, the procedure as outlined in ACI 318 shall be followed. Prepare test specimens in accordance with ASTM C192 and conduct strength tests in accordance with ASTM C39.

2. Required types of concrete and compressive strengths shall be as indicated on the Structural Drawings and as specified in the various sections of the Specifications.

3. All mix designs shall state the following information:
   a. Mix design number or code designation by which the Contractor shall order the concrete from the Supplier
   b. Structural member for which the concrete is designed (i.e. columns, shear walls, footings, etc.)
   c. Type of concrete whether normal weight or lightweight
   d. 28 day compressive strength
   e. Aggregate type, source, size, gradation, fineness modulus

f. Cement type and brand
g. Fly ash type and brand (if any)
h. Admixtures including air entrainment, water reducers, accelerators, and retarders
i. Slump
j. Proportions of each material used
k. Water cement ratio and maximum allowable water content
l. Method by which the concrete is intended to be placed (bucket, chute, or pump)

4. Concrete Suppliers Record of Quality Control: The concrete supplier's past record of quality control shall be used in the design of the concrete mixes to determine the amount by which the average concrete strength fcr should exceed the specified strength f'c as outlined in ACI 318. If a suitable record of test results is not available, the average strength must exceed the design strength by 1200 PSI as specified in ACI 318. After sufficient data becomes available from the job, the statistical methods of ACI 214 may be used to reduce the amount by which the average strength must exceed f'c as outlined in ACI 318.

5. Admixtures:
   a. Admixtures to be used in concrete shall be subject to the approval of the Engineer and Testing Laboratory.

   b. Quantities of admixtures to be used shall be in strict accordance with the manufacturers instructions.

   c. Admixtures containing chloride ions shall not be used in prestressed concrete, in concrete containing galvanized or aluminum embedments, or in metal deck floors or roofs.

   d. Air entraining admixtures shall conform to "Specification for Air Entraining Admixtures for Concrete" ASTM C260.

   e. Water reducing admixtures, retarding admixtures, accelerating admixtures, water reducing and retarding admixtures, and water reducing and accelerating admixtures shall conform to "Specification for Chemical Admixtures for Concrete" ASTM C494.

   f. Fly ash or other pozzolons, used as admixtures, shall conform to "Specification for Fly Ash and Raw or Calcined Natural Pozzolons for use in Portland Cement Concrete" ASTM C618. Obtain mill test reports for approval. Maximum flyash content shall be 20%.

   g. Use amounts of admixtures as recommended by the manufacturer for climatic conditions prevailing at the time of placing. Adjust quantities of admixtures as required to maintain quality control.

6. Slump Limits: Unless shown otherwise on the structural drawings, proportion and design mixes to result in concrete slump at the point of placement as follows:
   a. Ramps and Sloping surfaces - 3" ± 1"
   b. Foundation concrete - 4-1/2" ± 1-1/2"
   c. All other concrete - 4" ± 1"

   When increased workability, pumpability, lower water-cement ratio, shrinkage reduction, or permeability reduction is required, then a superplasticizer admixture shall be considered for use. The maximum slump with the use of superplasticizers shall be 8 inches unless approved otherwise by the Architect/Engineer and Testing Laboratory.

   Any deviation from these values (such as concrete design to be pumped) shall be submitted to the Engineer and Testing Laboratory for approval.

7. Adjustments of Concrete Mixes: Mix design adjustments may be requested by the Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant. Such mix design adjustments shall be provided at no additional cost to the Owner. Any adjustments in approved mix designs including changes in admixtures shall be submitted in writing to the Engineer and Testing Laboratory for approval prior to field use.

8. Shrinkage: All concrete shall be proportioned for a maximum allowable unit shrinkage of 0.03% at 28 days as determined by ASTM C 157.

9. Chloride Ion Content: A written submittal shall be made with each mix design proposed for use on the project that the chloride ion content from all ingredients including admixtures will not exceed the limits specified in the Cast-In-Place section of the Specifications.

D. Concrete Test Cylinders by the Testing Laboratory:

1. Molding and Testing: Cylinders for strength tests shall be molded and Laboratory cured in accordance with ASTM C31 "Method of Making and Curing Concrete Test Cylinders in the Field" and tested in accordance with ASTM C39 "Method of Testing for Compressive Strength of Cylindrical Concrete Specimens".

2. Field Samples: Field samples for strength tests shall be taken in accordance with ASTM C172 "Method of Sampling Fresh Concrete".

3. Frequency of Testing: Each set of test cylinders shall consist of a minimum of four standard test cylinders. A set of test cylinders shall be made according to the following frequency guidelines:

a. One set for each class of concrete taken not less than once a day.

b. Mat Foundation: One set for each 250 cubic yards or fraction thereof.

c. All Other Concrete: A minimum of one set for each 150 cubic yards or fraction thereof.

d. No more than one set of cylinders at a time shall be made from any single truck.

e. If the total volume of concrete is such that the frequency of testing as specified above would provide less than five strength tests for a given class of concrete, tests shall be made from at least five randomly selected batches or from each batch if fewer than five batches are used.

f. The above frequencies assume that one batch plant will be used for each pour. If more than one batch plant is used, the frequencies cited above shall apply for each plant used.

The cylinders shall be numbered, dated, and the point of concrete placement in the building recorded. Of the four cylinders per set break one at seven days, two at 28 days, and one automatically at 56 days only if either 28 day cylinder break is below required strength.

4. Cylinder Storage Box: The Contractor shall be responsible for providing a protected concrete cylinder storage box at a point on the jobsite mutually agreeable with the Testing Laboratory for the purpose of storing concrete cylinders until they are transported to the Laboratory.

5. Transporting Cylinders: The Testing Laboratory shall be responsible for transporting the cylinders to the Laboratory in a protected environment such that no damage or ill effect will occur to the concrete cylinders.

6. Information on Concrete Test Reports: The Testing Laboratory shall make and distribute concrete test reports after each job cylinder is broken. Such reports shall contain the following information:

a. Truck number and ticket number
b. Concrete Batch Plant
c. Mix design number
d. Accurate location of pour in the structure
e. Strength requirement
f. Date cylinders made and broken
g. Technician making cylinders
h. Concrete temperature at placing
i. Air temperature at point of placement in the structure
j. Amount of water added to the truck at the batch plant and at the site and whether it exceeds the amount allowed by the mix design
k. Slump
l. Unit weight
m. Air content
n. Cylinder compressive strengths with type of failure if concrete does not meet Specification requirements. Seven day breaks are to be flagged if they are less than 60% of the required 28 day strength. 28 day breaks are to be flagged if either cylinder fails to meet Specification requirements.

E. Other Required Tests of Concrete by the Testing Laboratory (unless noted otherwise):

1. Slump Tests: Slump Tests (ASTM C143) shall be made at the beginning of concrete placement for each batch plant and for each set of test cylinders made.

2. Air Entrainment: Air entrainment (ASTM C233) tests shall be made at the same time slump tests are made as cited above.

3. Concrete Temperature: Concrete temperature at placement shall be measured at the same time slump tests are made as cited above.

4. Chloride Ions: The Contractor shall have the laboratory verify in a written submittal with the mix designs that the chloride ion concentration will not exceed the limits specified.

Tests shall be run for each class of concrete according to AASHTO Designation T 260-82 Sampling and Testing for Total Chloride Ion in Concrete and Concrete Raw Materials to determine that the maximum chloride ion content does not exceed the limits stated in the concrete section of the specifications. One test shall be run for each set of cylinders specified to be taken for each class of concrete.

F. Evaluation and Acceptance of Concrete:

1. Strength Test: A strength test shall be defined as the average strength of two 28 day cylinder breaks from each set of cylinders.

2. Quality Control Charts and Logs: The Owner's Testing Laboratory shall keep the following quality control logs and charts for each class of concrete containing more than 2,000 cubic yards. The records shall be kept for each batch plant and submitted on a weekly basis with cylinder test reports:
a. Number of 28 day strength tests made to date.
b. 28 day strength test results containing the average of all strength tests to date, the high test result, the low test result, the standard deviation, and the coefficient of variation.
c. Number of tests under specified 28 day strength.
d. A histogram plotting the number of 28 day cylinders versus compressive strength.
e. Quality control chart plotting compressive strength test results for each test.
f. Quality control chart plotting moving average for strength where each point plotted is the average strength of three previous test results.
g. Quality control chart plotting moving average for range where each point plotted is the average of 10 previous ranges.

3. Acceptance Criteria: The strength level of an individual class of concrete shall be considered satisfactory if both of the following requirements are met:
   a. The average of all sets of three consecutive strength tests equal or exceed the required f'c.

   b. No individual strength test (average of two 28 day cylinder breaks) falls below the required f'c by more than 500 PSI.

   If either of the above requirements is not met, the Testing Laboratory shall immediately notify the Engineer by telephone. Steps shall immediately be taken to increase the average of subsequent strength tests.

G. Investigation of Low Strength Concrete Test Results:
1. Contractor Responsibility for Low Strength Concrete: If any strength test of Laboratory cured cylinders falls below the required f'c by more than 500 psi, the Contractor shall take steps immediately to assure that the load carrying capacity of the structure is not jeopardized.

2. Nondestructive Field Tests: The Testing Laboratory shall under the direction of the Engineer perform nondestructive field tests of the concrete in question using Swiss Hammer, Windsor Probe, or other appropriate methods as approved by the Engineer and report the results in the same manner as for cylinder test reports.

3. Core Tests: If the likelihood of low strength concrete is confirmed and computations indicate that the load carrying capacity of the structure has been significantly reduced, tests of cores by the Testing Laboratory, drilled from the area in question under the direction of the Engineer, will be required in accordance with ASTM C42 "Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete". In such case, three cores shall be taken for each strength test more than 500 PSI below required f'c. If concrete in the structure will be dry under service conditions, cores shall be air dried (temperature 60° to 80°F, relative humidity less than 60 percent) for 7 days before test and shall be tested dry. If concrete in the structure will be more than superficially wet under service conditions, cores shall be immersed in water for at least 48 hours and tested wet. The Contractor shall fill all holes made by drilling cores with an approved drypack concrete.

4. Acceptance Criteria for Core Tests: Concrete in an area represented by core tests shall be considered structurally adequate if the average of three cores is equal to at least 85% of f'c and if no single core is less than 75% of f'c. If approved by the Engineer, locations of erratic core strengths may be retested to check testing accuracy.

5. Load Test: If the above criteria are not met and the structural adequacy remains in doubt, the Engineer may order a load test as specified in ACI 318 for the questionable portion of the structure.

6. Strengthening of the Structure or Demolition: If the structural adequacy of the affected portion of the structure remains in doubt, the Engineer may order the structure to be strengthened by an appropriate means or demolished and rebuilt.

7. Cost of Investigations for Low Strength Concrete: The costs of all investigations of low strength concrete shall be borne by the Contractor.

H. Jobsite Inspection: The scope of the work to be performed by the inspector on the jobsite shall be as follows:
   1. Verify that air temperatures at the point of placement in the structure are within acceptable limits defined above prior to ordering of concrete by the Contractor.

   2. Inspect concrete upon arrival to verify that the proper concrete mix number, type of concrete, and concrete strength is being placed at the proper location.

3. Inspect plastic concrete upon arrival at the jobsite to verify proper batching. Observe mix consistency and adding of water as required to achieve target slumps in mix designs. Record the amount of water added and note if it exceeds that allowed in the mix design. The responsibility for adding water to trucks at the jobsite shall rest only with the Contractor's designated representative. The Contractor is responsible that all concrete placed in the field is in conformance to the Contract Documents.

4. Obtain concrete test cylinders.

5. Perform slump tests and air entrainment tests.

6. Record information for concrete test reports.

7. Verify that all concrete being placed meets job Specifications. Report concrete not meeting the specified requirements and immediately notify the Contractor, Batch Plant Inspector, Contractor, Architect, Engineer, and Owner.

8. Pick up and transport to Laboratory, cylinders cast the previous day.

9. Check concrete placing techniques to determine that concrete deposited is uniform and that vertical drop does not exceed six feet.

10. The jobsite inspector shall report any irregularities that occur in the concrete at the jobsite or test results to the Contractor, Architect, Owner, and Engineer.

I. Causes for Rejection of Concrete:

The Contractor shall reject all concrete delivered to the site for any of the following reasons:

1. Wrong class of concrete (incorrect mix design number).

2. Air temperature:
Air temperature limits shall be as follows:
a. Cold Weather: Air temperature must be 40°F and rising
b. Hot Weather: Air temperature must be cooler than 100°.

Concrete may be placed at other air temperature ranges only with approval of the job inspector for the Testing Laboratory or other duly appointed representative.

3. Concrete with temperatures exceeding 95°F may not be placed in the structure.

4. Air contents outside the limits specified in the mix designs.

5. Slumps outside the limits specified in the mix designs.

6. Excessive Age:
Concrete shall be discharged within 90 minutes of plant departure or before it begins to set if sooner than 90 minutes unless approved by the Laboratory job inspector or other duly appointed representative.

The Contractor is responsible that all concrete placed in the field is in conformance to the Contract Documents.

J. Concrete Batch Trip Tickets: All concrete batch trip tickets shall be collected and retained by the Contractor. Compressive strength, slump, air, and temperature tests shall be identified by reference to a particular trip ticket. All tickets shall contain the information specified in ASTM C 94. Each ticket shall also show the amount of water that may be added in the field for

the entire batch that will not exceed the specified water cement ratio for the design mix. The Contractor and Testing Laboratory shall immediately notify the Architect/Engineer and each other of tickets not meeting the criteria specified.

3.5 STRUCTURAL STEEL

A. Contract Obligations:

1. Owner Responsibility: The Owner shall pay for all initial field inspections and tests as required during the fabrication and erection of the structural steel.

2. Contractor Responsibility: The Contractor shall arrange with the Owner's Testing Laboratory for the certification of all shop and field welders. Each bolting crew and welder shall be assigned an identifying symbol or mark and all shop and field connections shall be so identified so that the inspector can refer back to the person or crew performing the work. The costs of all retesting of material or workmanship not in conformance with the Contract Documents shall be borne by the Contractor. The Fabricator and Erector shall provide the Laboratory inspector with access to all places where work is being done. A minimum of 24 hours notification shall be given prior to commencement of work. The Contractor shall provide the Testing Laboratory with the following:
   a. A complete set of Architect/Engineer reviewed shop and erection drawings including all revisions and addenda.
   b. Cutting lists, order sheets, material bills, shipping bills, and mill test reports.
   c. Information as to time and place of all rollings and shipment of material to shops.
   d. Representative sample pieces requested for testing.
   e. Full and ample means and assistance for testing all material.
   f. Proper facilities, including scaffolding, temporary work platforms, hoisting facilities, etc., for inspection of the work in the mills, shop and field.

3. Testing Laboratory Responsibility:
   Inspection of field work shall be completed promptly so that corrections can be made without delaying the progress of the work. Inspections shall be performed by qualified technicians with a minimum of two years experience in structural steel testing and inspection. All inspection personnel shall be certified in accordance with AWS QC-1. The Testing Laboratory shall provide test reports of all shop and field inspections. Shop test reports shall include shop welders certifications. All test reports shall indicate types and locations of all defects found during inspection, the measures required and performed to correct such defects, statements of final approval of all welding and bolting of shop and field connections, and other fabrication and erection data pertinent to the safe and proper welding and bolting of shop and field connections. In addition to the parties listed in this Specification the Fabricator and Erector shall receive copies of all test reports.

4. Rejection of Material or Workmanship: The Owner, Architect, Engineer, and Testing Laboratory reserve the right to reject any material or workmanship not in conformance with the Contract Documents at any time during the progress of the work. However, this provision does not allow waiving the obligation for timely, in sequence inspections.

B. Mill Tests of Structural Steel:

1. Mill Order Steel: The Fabricator shall furnish certified mill test reports and an affidavit stating that the structural steel furnished meets the requirements of the grade specified on the structural drawings for all mill order steel. In case of controversy, test of the material according to ASTM A6 or A568 as applicable made by the Contractor's Testing Laboratory with certified test reports paid for by the Contractor shall be made to verify conformity with ASTM standards. Tests shall be made for each 10 tons of material used unless approved otherwise by the Engineer.

2. Local Stock Steel: Materials taken from stock by a Fabricator for use for structural purposes must be of a quality at least equal to that required by the ASTM specifications

applicable to the classification covering the intended use. Certified mill test reports shall be accepted as sufficient record of the quality of materials carried in stock by the fabricator provided the stock steel can be identified by heat or melt numbers. In case of controversy, tests by the Contractor's Testing Laboratory with certified reports as specified for mill order steel shall be required.

3. If tests are required, test specimens shall be taken by the Contractor under the direction of the Testing Laboratory and shall be machined by the Testing Laboratory to dimensions as required by the applicable ASTM standards.

C. Field Inspections and Tests: The Owner's Testing Laboratory shall provide inspection in the field for a period of time as determined in consultation with the Architect, Owner, and Engineer prior to the start of erection in a timely manner so as to not delay the start of erection. The following tests and inspections shall be made:

1. Obtain the planned erection procedure, and review with the Erectors supervisory personnel.

2. Check the installation of base plates for proper leveling, grout type, and grout application.

3. Verify field welding procedures and obtain welder certificates. (Including welding of cold formed framing.)

4. Check steel as received in the field for possible shipping damage, workmanship, and piece marking.

5. Check plumbness and frame alignment as erection progresses.

6. Check joint preparation and fit up, backing strips, and runout plates for welded moment connections and column splices.

7. Check preheating to assure proper temperature, uniformity, and thoroughness through the full material thickness.

8. Review welding sequence.

9. Visually inspect all field welding for size, length, and quality.

10. Perform nondestructive examination services for various weldments of field erection determined in consultation with the Structural Engineer prior to the start of erection. The Laboratory shall furnish a qualified technician with the necessary equipment to perform radiographic, ultrasonic, magnetic particle, or dye penetrant inspection as required for the item being tested and other duties as outlined for shop inspection in the previous Section. Unless specified otherwise, check all partial and complete penetration welds in connections of beams, girders, columns, and braces. Check 10% of connections with fillet welds. Visual inspection is required for all welds.

11. Check calibration of impact wrenches used in field bolted connections.

12. Check high strength friction field bolted connections according to inspection procedures outlined in the "Specification for Structural Joints Using ASTM A325 or A490 Bolts." Unless specified otherwise, test 10% of the bolts, but not less than two bolts, selected at random in each connection. If any bolt is found to be improperly tightened, test all bolts in the connection. Visually inspect all bearing type bolts to verify that the bolts are snug tight.

13. Perform field tests on 10% of completed shear connectors in each beam according to inspection procedures outlined in AWS D1.1

The costs of repairing all defective welds and the costs of retesting by the Owner's Testing Laboratory shall be borne by the Contractor. If removal of a backing strip is

required by the Owner's Testing Laboratory to investigate a suspected weld defect, such cost shall be borne by the Contractor.

3.6 MASONRY:

A. Prism Tests (by the Owner's Testing Laboratory):

1. Scope: Prism tests shall be made for each class of masonry (hollow masonry, grouted masonry, or composite masonry) on the project using an assembly of actual masonry units, mortar, and grout (if specified) as planned in the work.

2. Compressive Strength Test: Test shall be run according to the requirements of ASTM E447 "Test Methods for Compressive Strength of Masonry Prisms." Each strength test shall be defined as the average of three test prisms from the same class of masonry.

3. Frequency of Testing:

a. Interior Non-Load Bearing Walls: One strength test shall be run for each 5,000 square feet of wall or fraction thereof.

b. Exterior Walls and All Loadbearing Walls: One strength test shall be run for each 5,000 square feet of wall area but not less than one strength test for each day's operation for each class of wall. An additional test should be run whenever there is a change in mortar or grout proportions.

B. Mortar Test:

1. Scope: Mortar cube test shall be required only for loadbearing masonry construction (hollow or grouted) for the purpose of measuring uniformity of field batching.

2. Compressive Strength Test: Tests shall be run according to the requirements of ASTM C780 "Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry." Each strength test shall be defined as the average of three cube specimens two inches in dimension tests at 28 days.

3. Frequency of Testing: One strength test shall be run for each 5,000 square feet of wall but not less than one strength test for each day's operation for each class of wall. An additional test should be run whenever there is a change in mix proportions.

C. Grout Tests:

1. Scope: Grout prism tests shall be required for all grout used in masonry construction.

2. Compressive Strength Test: Specimens shall be 3½"x3½"x7" or 3"x3"x6" cast in molds with a flat nonabsorbent base and masonry units having the same moisture condition as those being laid forming the sides of the specimens. Specimens shall be capped according to ASTM C617 and tested according to ASTM C39. Each strength test shall be defined as the average of two 28 day prisms.

3. Frequency of Testing: Four grout prisms shall e made for each 30 cubic yards of grout but not less than one set for each day's operation. An additional set should be made whenever the grout mix is changed. One prism shall be tested at 7 days, two at 28 days, and one at 56 days only if either 28 day test is low.

D. Hollow Load Bearing Concrete Masonry Units (by the Owner's Testing Laboratory):

1. Scope: Hollow masonry units shall be tested only for loadbearing masonry construction.

2. Compressive Strength Test: Three units from each 10,000 units or fraction thereof shall be tested according to the requirements of ASTM C140 "Sampling and Testing Concrete Masonry Units." Compressive strengths shall meet the requirements of ASTM C90 as specified on the drawings.

E. Experience Requirement:

Field inspection of masonry construction by the Owner's Testing Laboratory as herein described shall be performed by qualified technicians with a minimum of ten years experience in masonry testing and inspection.

F. Field Inspection Requirements:

The duties and responsibilities of the Testing Laboratory Inspector in the field shall be as follows:

1. Review and become familiar with project drawings and specifications.

2. Review all masonry materials used in the field for conformance to project specifications. This shall include masonry units, mortar, grout, portland cement, masonry cement, sand, lime, horizontal joint reinforcement, ties, masonry anchoring devices, to the structure, and control joint strips.

3. Review proper horizontal joint reinforcement size and spacing. Review size and spacing of wall ties.

4. Review proper masonry construction practices for mortar including requirements for high and low lift grouting. Check conformance with hot and cold weather construction requirements.

5. Verify proper mortar batching proportions.

6. Confirm clean outs for high lift grouting.

7. Verify construction tolerances.

8. Review and confirm installation of reinforcing steel size, spacing, and splices in all walls, lintels, pilasters, and columns.

9. Confirm number and size of dowels in the foundation to walls and columns.

10. Take mortar, grout, and prism samples as specified.

END OF SECTION 01410

SECTION 01500 – TEMPORARY FACILITIES AND CONTROLS

1.01 GENERAL

A. Definition of Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete, insulated and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

B. Use Changes: Cost or use charges for temporary facilities are not chargeable to Owner or Architect and shall be included in the Contract Sum.

C. Temporary Utility Reports: Submit reports of test, inspections meter readings, and similar procedures performed on temporary utilities.

D. Standards: Comply with ANSI A10.6, NECA's "Temporary Electrical Facilities," and NFPA 241.
   1. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

E. Temporary Utilities: At earliest feasible time, when acceptable to Owner, change over from use of temporary service to use of permanent service.
   1. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

F. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:
   1. Keep temporary service and facilities clean and neat.
   2. Relocate temporary services and facilities as required by progress of the Work.
   3. Relocations in existing building, as the building has employees working on specific separate tasks, shall be done quickly in a manner that provides the least disruption of the work of the Owner.

1.02 PRODUCTS

A. Materials: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.
   1. Chain-Link Fencing: Minimum 2-inch, 0.148-inch-thick, galvanized steel, chain0link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8.
   2. Tarpaulins: Fire-resistive labeled with flame-spread rating of 15 or less.
   3. Water: Potable.

B. Field Offices: Mobile units with lockable entrances.

C. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes doe exposures.
   1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

D. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a lass-fiber-reinforced polyester shell or similar nonabsorbent material.

E. Electrical Outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110-to 120-V plugs into higher-voltage outlets; equipped with ground-fault interrupters, reset button, and pilot light.

F. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125–V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.

1.03 EXECUTION

A. Installation, General: Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.
   1. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. DO not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

B. Temporary Utility Installation: Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.
   1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services. Contractor to inform owner/architect 48 hours in advance before services are interrupted.
   2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.
   3. Water Services: Install water services and distribution piping in sizes and pressures adequate for construction until permanent water service is in use.
   4. Sanitary Facilities: Toilets: Install self-contained toilet units.
   5. Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnecting means, automatic ground-fault interrupters, and main distribution switchgear.
   6. Electric Distribution: Provide receptacle outlets adequate for connection pf power tools and equipment.
      a. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
   7. Telephone Service: Continue to provide digital pager number and list of pager numbers for subs.

C. Support Facilities Installations: Comply with the following:
   1. Locate field officers, storage sheds, sanitary facilities, and other temporary construction and support facilities as directed by architect.
   2. Project Identification and Temporary Signs: Prepare Project identification and other signs in sizes indicated. Install signs where indicated to inform public and persons seeking entrance to Project. Do not permit installation of unauthorized signs.
      a. Prepare temporary signs to provide directional information to construction personnel and visitors.

D. Security and Protection Facilities Installation: Comply with the following:
   1. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near Project site.
   2. Stormwater Control: Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of stormwater from heavy rains.
   3. Site Enclosure Fence: When excavation begins, install chain-link enclosure fence with lockable entrance gates. Locate where indicated, or enclosed entire Project site or portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering site except by entrance gates.
      a. Set fence post in concrete bases.

b. Provide gates in sizes and at locations necessary to accommodate delivery vehicles and other construction operations.

4. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violation of security.
5. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.
6. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
   a. Provide fire extinguishers, installed on walls on mounting brackets, visible and accessible from space being served, with sign mounted above.
      1) Locate fire extinguishers where convenient and effective for their intended purpose; provide not less than one extinguisher on each floor at or near each usable stairwell.
   b. Store combustible materials in containers in fire-safe locations.
   c. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for firefighting. Prohibit smoking in hazardous fire-exposure areas.
   d. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
   e. Permanent Fire Protection: At earliest feasible date in each area of Project, complete installation of permanent fire-prevention facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
   f. Develop and supervise on overall fire-prevention and first-aid fire-protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct Personnel in methods and procedures. Post warnings and information.

E. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

F. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facilities. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
   1. Materials and facilities that constitute temporary facilities are the property of Contractor. Owner reserves right to take possession of Project identification signs.
   2. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements in Division 1 Section “Closeout Procedures.”

END OF SECTION

SECTION 01567 - POLLUTION CONTROL

PART 1 - GENERAL

1.01 GENERAL CONDITIONS

As specified in Section 00700.

1.02 REQUIREMENTS

A. RUBBISH DISPOSAL
1. No burning of debris and/or waste materials shall be permitted on the project site.
2. No burying of debris and/or waste material shall be permitted on the project site.
3. All unusable debris and waste material shall be hauled away to an appropriate off-site dump area. During loading operations, debris and waste materials shall be watered down to allay dust.
4. No dry sweeping shall be permitted in cleaning rubbish and fines, which can become airborne from floors or other paved areas. Vacuuming, wet mopping or wet or damp sweeping is permissible.
5. Clean up shall include the collection of all waste paper and wrapping materials, cans, bottles, construction waste materials and other objectionable materials, and removal as required. Frequency of clean up shall coincide with rubbish producing events.

B. DUST
1. The Contractor shall prevent dust from becoming airborne at all times including non-working hours, weekends and holidays in conformance with the State Department of Health, - Air Pollution Control.
2. The method of dust control and costs shall be the responsibility of the Contractor. Methods of dust control shall include the use of water or chemicals over surfaces, which may create airborne dust.
3. The Contractor shall be responsible for all damage claims in accordance with Section 7.16 - "Responsibility for Damage Claims" of the GENERAL CONDITIONS.

C. NOISE
1. Noise shall be kept within acceptable levels at all times in conformance with the rules communicated by the principal of the school.
2. All internal combustion engine-powered equipment shall have mufflers to minimize noise and shall be properly maintained to reduce noise to acceptable levels.
3. Operations, which produce noise, shall be confined to the period between 6:00 a.m. and 6:30 p.m., Monday through Friday. Special provision may be made for work on week-ends with the Owners Representative and Principal of the School.
4. Starting-up of construction equipment meeting allowable noise limits shall not be done prior to 6:45 a.m. without prior approval of the Engineer. Equipment exceeding allowable noise levels shall not be started-up prior to 6:00 a.m.

D. OTHERS
1. Wherever trucks and/or vehicles leave the site and enter surrounding paved streets, the Contractor shall prevent any material from being carried onto the pavement. Waste water shall not be discharged into existing streams, waterways, or drainage systems such as gutters and catch basins unless treated to comply with the State Department of Health water pollution regulations.
2. Trucks hauling debris shall be covered as required by local Regulation. Trucks hauling fine materials shall be covered.
3. No dumping of waste concrete will be permitted at the job-site unless otherwise permitted in the SPECIAL PROVISIONS.
4. Except for rinsing of the hopper and delivery chute, and for wheel washing where required, concrete trucks shall not be cleaned on the job-site.
5. Except in an emergency, such as a mechanical breakdown, all vehicle fueling and maintenance shall be done in a designated area. A temporary berm shall be constructed around the area when runoff can cause a problem.

6. When spray painting is allowed under Section 09910 - Painting, such spray painting shall be done by the "airless spray" process. Other types of spray painting will not be allowed.

F. SUSPENSION OF WORK

1. Violations of any of the above requirements or any other pollution control requirements which may be specified in the Technical Specifications herein shall be cause for suspension of the work creates such violation. No additional compensation shall be due the Contractor for remedial measures to correct the offense. Also, no extension of time will be granted for delays caused by such suspensions.
2. If no corrective action is taken by the Contractor within 72 hours after a suspension is ordered by the Engineer, the State reserves the right to take whatever action is necessary to correct the situation and to deduct all costs incurred by the State in taking such action from monies due the Contractor.
3. The Engineer may also suspend any operations which he feels are creating pollution problems although they may not be in violation of the above-mentioned requirements. In this instance, the work shall be done by force account as described in Subsection 4.2a - "Additional Work" of the GENERAL CONDITIONS and paid for in accordance with Subsection 8.4b - "Force- Account Work" therein. The count of elapsed working days to be charged against the contract in this situation shall be computed in accordance with Subsection 7.18 - "Contract Time" of the GENERAL CONDITIONS.

END OF SECTION

SECTION 01600 – PRODUCT REQUIREMENTS

1.1 GENERAL

A. Definitions: As follows:

1. Products: Item purchased for incorporation into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "materials", "equipment," "system." And terms of similar intent.
    a. Named Products: Items identified by manufacturer's product name, including make model number or other designation, shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
    b. New Products: Items that have not previously been incorporated into another project or facility, (Except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise). Products salvaged or recycled from other projects are not considered new products.
    c. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
    d. These qualifications may not apply when applied to required TDI Windstorm insurable elements including doors, windows and roof materials. These materials must be approved systems for TDI acceptance, not portions of various systems, but the complete approved system as tested by Texas Department of Insurance or a TDI accepted Testing Laboratory. Refer to Structural Requirements.

2. Substitution: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
3. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design", including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.
4. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by Manufacturer to Owner.
5. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

B. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specifications Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use CSI Form 13.1A.
2. Documentation: Show compliance with requirements for substitution and the following as applicable:
    a. Statement indicating why specified material or product cannot be provided.
    b. Coordination information, including a list of changes or modifications needed to accommodate proposed substitution.
    c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified.
    d. Product Data, including drawings and descriptions of products and fabrication and installation procedure.
    e. Samples, where applicable or requested.

f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
g. Material test reports from a qualified testing agency indicating and interoperating test result for compliance with requirements indicated.
h. Research/evaluation reports evidencing compliance with building code in effect for Project, from model code organization acceptable to authorities having jurisdiction.
i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with product specified for the Work, including effect on the overall Contract Time.
j. Cost information, including a proposal of change, if any, in the Contract Sum.
k. Contractor's certification that proposed substitution complies with requirements in Contract Documents and is appropriate for application indicated.
l. Contractor's waiver of rights to additional payment or time that my subsequently become necessary because of failure of proposed substitution to produce indicated results

3. Architect's Action: If necessary, Architect will request additional information or documents for evaluation with one week of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution with 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
   a. Form of Acceptance: Change Order.
   b. Use product specified if Architect cannot make a decision on use of a propose substitution with time allocated.

C. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 1 Section "Submittal Procedures". Show compliance with requirements.

D. Compatibility of Options: If Contractor id given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

E. Product Delivery, Storage, and Handling: Use means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordination delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, an other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
5. Store products to allow for inspection and measurement of quantity or counting of units.
6. Store materials in a manner that will not endanger Project Structure.
7. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground. With ventilation adequate to prevent condensation.
8. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
9. Protect stored products from damage.

F. Product Warranties: Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of Obligations under requirements of the Contract Documents.
1. Special warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

a. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
b. Specified Form: Forms are included with the Specification. Prepare a written document using appropriate form properly executed.
c. Refer to Division 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.

2. Submittal Time: Comply with requirements in Division 1 Section "Closeout Procedure"

1.2 PRODUCTS

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged, unless otherwise indicated, that are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have bee produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict wit requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected", Architect will make selection.
5. Where products are accompanied b the term "match sample," sample to be matched is Architects.
6. Descriptive, performance, and reference standard, requirements in the Specifications establish "salient characteristics" pf products.

B. Product Selection Procedure: Procedures for product selection include the following:
1. Product: Where Specification paragraphs or subparagraphs titled "Product" name a single product and manufacturer, provide the product named.
a. Substitutions may be considered, **(unless otherwise indicated)**
2. Manufacturer/Source: Where Specification paragraphs or subparagraphs titled "manufacturer" or "Source" name single manufacturer or sources, provide a product by the manufacturer or from the source named that complies with requirements.
a. Substitution may be considered, **(unless otherwise indicated)**
3. Products: Where Specifications paragraphs or subparagraphs titled "Product" introduce a list of names of both products and manufacturer, provide one of the products listed that complies with requirements.
a. Substitution may be considered, **(Unless others wise indicated)**
4. Manufacturer: Where Specification paragraphs or subparagraphs titled "Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
a. Substitution may be considered, **(unless otherwise indicated)**
5. Product Options: Where Specifications paragraphs titled "Product Options" indicate that size, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide either the specific product or system indicated or comparable product or system by another manufacturer. Comply with provisions in "Product Substitution" Paragraph.
6. Visual Matching Specification: Where Specification require matching an established Sample, select a product (and manufacturer) that complies with requirements and matches Architect sample. Architect's decision will be final on whether a proposed product matches satisfactorily.

a. If no product available within specified category matches satisfactorily and complies with other specified requirements, comply with provisions of the Contract Documents on "substitutions' for selection of a matching product.

7. Visual Selection Specifications: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, and textures" or a similar phrase, select a product (and manufacturer) that complies with other specified requirements.
   a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, texture" or similar phrases, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.
   b. Full Range: Where Specifications include the phrases "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes standard and premium items.

C. Product Substitution: Architect will consider requests for substitution if received with 10 days after the Notice of Award. Requests received after that time may be considered or rejected at discretion of Architect.
   1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
      a. Requested substitution offers Owner a substantial advantage in cost, time, energy, conservation, or other considerations, after deducting additional responsibilities Owner must assume.
      b. Requested substitution does not require extensive revisions to the contract Documents.
      c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
      d. Substitution request is fully documented and properly submitted.
      e. Requested substitution will not adversely affect Contractor's Constructions schedule.
      f. Requested substitution has received necessary approvals of authorities having jurisdiction.
      g. Requested substitution is compatible with other portions of the Work
      h. Requested substitution has been coordinated with other portions of the Work.
      i. Requested substitution provides specified warranty

D. Comparable Products: Where products or manufactures are specified by name, submit the following, in addition to other required submittals, to obtain approval of an unnamed product:
   1. Evidence that the proposed product does not require extensive revisions to the Contract Documents that is consistent with Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
   2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
   3. Evidence that proposed product provides specified warranty
   4. List similar installations for complete projects with project names and addresses and names and addresses of architects and owners, if requested.
   5. Samples, if requested.

1.3 EXECUTION (Not used)

END OF SECTION

SECTION 01605 – WARRANTIES AND MAINTENANCE

PART 1 – GENERAL

Drawings, Standard General Conditions of Contract, Supplementary Conditions and Division-1 specification sections, apply to work of this section.

1.01 DESCRIPTION

Warranties (guarantees), maintenance and service.

1.02 WARRANTIES (GUARANTEES)

Provide a written warranty and guarantee of all work against defects in materials, equipment, or workmanship for a period of **One Year** from the date of final acceptance. Provide a written warranty and guarantee for all HVAC, Electrical and Plumbing Systems for **Two Years** from date of final acceptance. Also provide any additional warranties and guarantees of work items and components as specified in individual sections of these specifications. Other warrantees that may be longer shall remain in effect for the longer duration.
This is in addition to, and not in lieu of, the contractor's obligations under the General Conditions, including without limitation, Section 3.2 and 12.2.2.

1.03 SERVICE

A. All necessary service to each component, such as adjustment or repair due to defects in materials or workmanship, shall be furnished by the Contractor, at no cost to the Owner, for a period one year and/or two year, concurrent with the warranty period specified above. This shall not include repair of damage due to fire (unless the fire results from facility material or workmanship on the part of the Contractor) storm, vandalism, or other factors entirely beyond the control of the Contractor.

B. The Contractor will receive no addition compensation for work performed during the one year or two year warranty periods.

PART 2 – PRODUCTS

(Not applicable)

PART 3 – EXECUTION

3.01 WARRANTIES

A. All product warranties and/or guarantees provided by subcontractors, suppliers and/or manufactures for the specific items, such as building components, mechanical equipment, air conditioners, unit heaters, water heaters, and water coolers will be completely filled by the contractor. Provide documents in the Owner's name. Show all model numbers, serial numbers, date installed or accepted as required to complete the warranty/guarantee forms.

END OF SECTION

SECTION 01620 - STORAGE AND PROTECTION

1.01 SUMMARY

A. Product products scheduled for use in the work by means including, but not necessarily limited to, those described in this Section.
B. Related work:
   1. Documents affecting work of this Section includes, but are not necessarily limited to the Agreement, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
   2. Additional procedures also may be prescribed in other Sections of these Specifications.

1.02 QUALITY ASSURANCE

A. Include within the contractor's quality assurance program such procedures as are required to assure full protection of the work and materials.

1.03 MANUFACTURER'S RECOMMENDATIONS

A. Except as otherwise approved by the Architect, determine and comply with manufacturers' recommendations on product handling, storage and protection.

1.04 PACKAGING

A. Deliver products to the job site in their manufacturer's original container, with labels intact and legible.
   1. Maintain packaged materials with seals unbroken and labels intact until time of use.
   2. Promptly remove damaged material and unsuitable items from the job site, and promptly replace with material meeting the specified requirements, at no additional cost to the Owner.

B. The Architect may reject as non-complying such material and products that do not bear identification satisfactory to the Architect as to manufacturer, grade, quality, and other pertinent information.

1.05 PROTECTION

A. Protect finished surfaces, including jambs and soffits and ceilings of openings used as passageways, through which equipment and materials are handled.
B. Provide protection for finished floor surfaces in traffic areas prior to allowing equipment or materials to be moved over such surfaces.
C. Maintain finished surfaces clean, unmarred, and suitably protected until accepted by the Owner.

END OF SECTION

SECTION 01700 - CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 SUMMARY

A. This Section describes an orderly and efficient transfer of the completed Work to the Owner.

B. Related work:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Activities relative to Substantial Completion and Contract Closeout are described in the General Conditions.

1.02 QUALITY ASSURANCE

A. Prior to requesting inspection by the Architect, use adequate means to assure that the work is completed in accordance with the specified requirements and is ready for the requested inspection.

1.03 PROCEDURES

A. Substantial completion
1. Prepare and submit the list required by the first sentence of Paragraph 9.8.2 of the General Conditions.
2. Within a reasonable time after receipt of the list, the Architect will inspect to determine status of completion.
3. Should the Architect determine that the Work is not substantially complete:
   a. The Architect promptly will so notify the Contractor, in writing, giving the reasons therefore.
   b. The Contractor shall remedy the deficiencies and notify the Architect when ready for reinspection.
   c. The Architect will re-inspect the Work.
4. When the Architect concurs that the Work is substantially complete:
   a. The Architect will prepare a "Certificate of substantial Completion", accompanied by the Contractor's list of items to be completed or corrected, as verified by the Architect.
   b. The Architect will submit the Certificate to the Owner and to the Contractor for their written acceptance of the responsibilities assigned to them in the Certificate.

B. Final Completion:
1. Prepare and submit the notice required by the first sentence of Paragraph 9.10.1 of the General Conditions.
2. Verify that the Work is complete including, but not necessarily limited to, the items mentioned in Paragraph 9.10.2 of the General Conditions. Contractor shall Certify that:
   a. Contract Documents have been reviewed;
   b. Work has been inspected for compliance with the contract Document.
   c. Work has been completed in accordance with the Contract Documents;
   d. Equipment and systems have been tested as required, and are operational;
   e. Work is completed and ready for final inspection.
3. The Architect will make an inspection to verify status of completion.
4. Should the Architect determine that the Work is incomplete or defective:
   a. The Architect promptly will so notify the Contractor, in writing, listing the incomplete or defective work.
   b. Contractor shall remedy the deficiencies promptly, and notify the Architect when ready for re-inspection.

5. When the Architect determines that the Work is acceptable under the Contract Documents, he will request the Contractor to make closeout submittals.

C. Closeout submittals include, but are not necessarily limited to:
   1. Project Record Documents;
   2. Operation and maintenance data, manuals & instruction for items listed in pertinent other Sections of these Specifications, and for other items when so directed by the Architect;
   3. Warranties and bonds;
   4. Keys and keying schedule;
   5. Spare parts and materials extra stock;
   6. Evidence of compliance with requirements of governmental agencies having jurisdiction including; but not necessarily limited to:
      a. Certificates of Inspection;
      b. Certificates of Occupancy;
   7. Certificates of Insurance for products and completed operations;
   8. Evidence of payment and release of liens;
   9. List of subcontractors, service organizations, and principal vendors, including names, addresses, and telephone numbers where they can be reached for emergency service at all times including nights, weekends, and holidays.

D. Final adjustment of accounts:
   1. Submit a final statement of accounting to the Architect, showing all adjustments to the Contract Sum.
   2. If so required, the Architect will prepare a final Change Order showing adjustments to the Contract Sum, which was not made previously by Change Orders.

1.04 INSTRUCTION

A. Instruct the Owner's personnel in proper operation and maintenance of systems, equipment, and similar items, which were provided as part of the Work.

END OF SECTION

SECTION 01731 - CUTTING AND PATCHING

PART 1 – GENERAL

1.01 SUMMARY

A. This Section includes procedural requirements for cutting and patching.
B. See Division 7 Section "Through-Penetration Firestop Systems" for patching fire-rated construction.
C. See Specification all Divisions Sections for specific requirements and limitations applicable to cutting & patching individual parts of the Work.
D. Requirements in this Section apply to mechanical and electrical installations. See Divisions 15 and 16 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.02 SUBMITTALS

A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 5 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
   1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
   2. Changes to Existing Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
   3. Products: List products to be used and firms or entities that will perform the Work.
   4. Dates: Indicate when cutting and patching will be performed.
   5. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.
   6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
   7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.03 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
C. Miscellaneous Elements: Do not cut and patch the following elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or those results in increased maintenance or decreased operational life or safety.
   1. Load bearing wood studs or horizontal joists, rafters, lintels, headers and beams.
   2. Any diagonal strut or stay without first installing equivalent member(s).

D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
   1. If possible, retain original Installer or fabricator to cut and patch exposed Work listed below. If it is impossible to engage original Installer or fabricator, engage another recognized, experienced, and specialized firm.
      a. Tooth all unit masonry cutting and reinstallation.
      b. Replicate hand textured and patterned surfaces with matching grit, tools, hand motion,

pressure, wet and rewet, knock-down, etc. as was utilized in the original work.

c. Do not square cut demolished materials when such abrupt demarcation points and lines will photograph, crack or otherwise be visible in the patched finish. Break back, over cut and use random hand techniques to prepare the edge for patching. Lap and feather new materials and blend new to old with care to provide invisible repair in the finished work.

d. Apply finish coats and finishes in adequate light. Step back from the work underway and confirm quality of craft and match to existing finishes being replicated. Use bright artificial lighting from an oblique angle to detect changes of line and plane that will show in the finished work. Rework discovered imperfections in the surfaces prior to proceeding with succeeding steps.

1.04 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Comply with requirements specified in other Sections of these Specifications.

B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.
2. Advise Architect and Owner prior to installation of materials to remain exposed in the finished work when initial visual match might be objectionable, but weathering or reasonable aging duration will improve the appearance.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

2.01 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to and from adjoining areas.

D. Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to avoid interruption of services to occupied areas.

1. Provide 24 hours advance notice to Owner if interruption of services cannot be avoided. Have equipment, materials and manpower available so as to minimize duration of service interruption once commenced.

3.01 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as

required to restore surfaces to their original condition.

B. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
   1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
   3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
   4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
   5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
      a. See Div. 15 and 16 for specific controls and confirmation of abandonment of existing services
   6. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
   1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
   2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
      a. Texturing and decorator finishes will extend floor to ceiling and corner-to-corner or other natural break to avoid cloud evidence of spot work.
   3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
   4. Ceilings: Patch, repair, or re-hang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
   5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather tight condition.

END OF SECTION

SECTION 02810 - TERMITE CONTROL

PART 1 – GENERAL

1.1 SUMMARY

A. Provide soil poisoning to control subterranean termites as specified herein and needed for a complete and proper treatment.

B. Related work:
   1. Documents affecting work of this section include, but are not necessarily limited to, general conditions, supplementary conditions, and sections in division 1 of these specifications.

1.2 SUBMITTALS

A. Comply with pertinent provisions of section 01340.

B. PRODUCT DATA: within 35 calendar days after the contractor has received the owner's note to proceed, submit:
   1. Materials list of items proposed to be provided under this section;
   2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements;
   3. Manufacturer's recommended installation procedures which, when approved by the architect, will become the basis for accepting or rejecting actual installation procedures used on the work.

1.3 QUALITY ASSURANCE

A. Used adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.

B. Qualifications of subcontractor:
   1. Properly licensed to provide such services by governmental agencies having jurisdiction.
   2. Not less than 5 years successful experience in soil treatment for subterranean termites.

1.4 WARRANTY

A. Upon completion of the work, and as a condition of it's acceptance, deliver tot he architect two copies of a warranty signed by an authorized representative of the installing subcontractor, and co-signed by the contractor, agreeing:
   1. To make an inspection of the work once each year for a period of five years following date of substantial completion for the purpose of detecting termite infestation.
   2. If termite infestation is found during that five-year period, to retreat in accordance with prevailing practice of the trade and within ten calendar days after such infestation is discovered.
   3. To repair damage tot he work caused by subterranean termites during that five-year period, to a maximum cost of $5,000.00;
   4. To make such inspections, re-treatment, and repairs at no additional cost to the owner.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of section 01620

PART 2 – PRODUCTS

2.1 MATERIALS

A. To the extent approved by governmental agencies having jurisdiction, use working solutions containing any one of the following chemicals at the listed minimum concentration:
   1. Aldrin: 0.5%
   2. Heptachlor: 0.5%
   3. Diedrin: 0.5%

B. If combinations of toxicants are approved by governmental agencies having jurisdiction, provide toxicants having such approval and in the maximum strength so approved, at no additional cost to the owner.

PART 3 – EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.2 APPLICATION

A. Begin soil poisoning only after all preparations for slab placement is complete.

B. Slabs on grade:
   1. Apply toxicant as an overall treatment at the minimum rate of one gallon of toxicant to each square foot of area under slabs on grade within building lines.

C. Utility entrances:
   1. Apply toxicant at the rate of two gallons of toxicant per five lin ft at critical locations such as where utilities pass through exterior walls and through floor slabs.
   2. Extend treatment not less than 48" from wall into trench.

D. Walls:
   1. Apply toxicant at the rate of two gallons of toxicant per lin ft along both sides of all foundations: walls, cross walls, and grade beams, after all nearby excavation have been completed.
   2. Apply toxicant at the rate of one gallon of toxicant per five lin ft to voids in masonry walls.

E. Miscellaneous:
   Apply toxicant the rate of two gallons of toxicant per five lin ft at the following areas:
   1. Immediately below expansion joints, control joints, and all areas where slab will be penetrated by construction features.
   2. Where exterior facings or veneers extend below grade level along the exterior side of all foundations walls.
   3. Where unit masonry foundations construction is used.

F. If soil is disturbed after treatment, retreat disturbed areas.

END OF SECTION

SECTION 32 31 19 - Aluminum Ornamental Fence System – Internally Secured Construction Specification

ECHELON PLUS® AMERISTAR FENCE PRODUCTS®

PART 1 - GENERAL

1.01 WORK INCLUDED

The contractor shall provide all labor, materials and all necessary items for the installation of the Echelon Plus® ornamental aluminum fence system defined herein at (specify project site).

1.02 RELATED WORK

Section _ _ _ - Earthwork
Section _ _ _ - Concrete

1.03 SYSTEM DESCRIPTION

The manufacturer shall supply a total ornamental aluminum fencing system of the Ameristar Echelon Plus® Majestic™, design. The system shall include all components (i.e., pickets, posts, rails, gates and hardware) required.

1.04 QUALITY ASSURANCE

The contractor shall provide laborers and supervisors who are thoroughly familiar with the type of construction involved and the materials specified.

1.05 REFERENCES

- ASTM B117 - Practice for Operating Salt-Spray (Fog) Apparatus.
- ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.
- ASTM D523 - Test Method for Specular Gloss.
- ASTM D822 - Practice for Conducting Tests on Paint and Related Coatings and Materials using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus.
- ASTM D1654 - Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
- ASTM D2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
- ASTM D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
- ASTM D3359 - Test Method for Measuring Adhesion by Tape Test.

1.06 SUBMITTAL

The manufacturer's submittal package shall be submitted prior to installation to confirm compliance with all requirements for materials specified in this section.

1.07 PRODUCT HANDLING AND STORAGE

Upon receipt at the job site, all materials shall be checked to ensure that no damages occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage and to protect against damage, weather, vandalism and theft.

PART 2 - MATERIALS

2.01 MANUFACTURER

The ornamental fence system shall conform to Ameristar's Echelon Plus aluminum ornamental fencing Majestic, 3-rail, style manufactured by Ameristar Fence Products, Inc. in Tulsa, Oklahoma.

2.02 MATERIAL

A. Aluminum material for fence framework (i.e., tubular pickets, rails and posts) shall conform to the requirements of ASTM B221. The aluminum extrusions for posts and rails shall be Alloy and Temper Designation 6005-T52. The aluminum extrusions for pickets shall be Alloy and Temper Designation 6063-T52.

B. Pickets shall be 3/4" square x .045" thick. Horizontal rails shall be 1-1/4" x 1-7/16" Forerunner™ channel with .060" thick top & internal web wall, and .090" thick side walls and shall be punched to allow picket to pass through the top of the rail. The Forerunner rail shall be constructed with an internal web insert providing a raceway for the pickets to be retained with a 1/8" retaining rod. The number of rails shall vary with the style, height and strength as determined by manufacturer. Fence posts and gate posts shall meet the minimum size requirements of Table 1.

C. Accessories: Aluminum castings shall be used for all post caps, scrolls, finials, and other miscellaneous hardware. Hinges and latches shall be fabricated from aluminum, stainless steel or composite materials.

2.03 FABRICATION

A. Pickets, rails and posts shall be pre-cut to specified lengths. ForeRunner rails shall be pre-punched to accept pickets. Grommets shall be inserted into the pre-punched holes in the rails and pickets shall be inserted through the grommets so that pre-drilled picket holes align with the internal upper raceway of the ForeRunner rails (Note: This can best be accomplished by using an alignment template). Retaining rods shall be inserted into each ForeRunner rail so that they pass through the pre-drilled holes in each picket, thus completing the panel assembly.

B. The manufactured framework shall be subjected to the Ameristar thermal stratification coating process (high-temperature, in-line, multi-stage, and multi-layer) including, as a minimum, a six-stage pretreatment/wash and an electrostatic spray application of a polyester finish. The topcoat shall be a "no-mar" TGIC polyester powder coat finish with a minimum thickness of 2 mils (0.0508mm). The color shall be Black. The stratification-coated framework shall be capable of meeting the performance requirements for each quality characteristic shown in Table 2.

C. Finish: All fence components shall be subject to a six-stage pretreatment/wash followed by an electrostatic spray application of a "no-mar" TGIC polyester powder coat finish with a minimum thickness of 2-4 mils. The color shall be (specify black, bronze or white).

D. Completed panels shall be capable of supporting a 200 lb. load (applied at midspan) without permanent deformation. Panels without rings shall be biasable to a 12.5% change in grade.

E. Swing gates shall be fabricated using 1-1/4" x 1-7/16" Forerunner rail, 1.75" sq. x .125" gate ends, and 3/4" sq. x .080 pickets. Gates that exceed 6' in width will have a 1.75" sq. x .125" intermediate upright. All rail and upright intersections shall be joined by welding. All picket and rail intersections shall also be joined by welding.

PART 3 - EXECUTION

3.01 PREPARATION

All new installation shall be laid out by the contractor in accordance with the construction plans.

3.02 FENCE INSTALLATION

Fence post shall be spaced according to Table 3, plus or minus ½". For installations that must be raked to follow sloping grades, the post spacing dimension must be measured along the grade. Fence panels shall be attached to posts with brackets supplied by the manufacturer. Posts shall be set in concrete footers 33" depth recommended (Note: In some cases, local restrictions of freezing weather conditions may require a greater depth). The "Earthwork" and "Concrete" sections of this specification shall govern material requirements for the concrete footer. Posts setting by other methods such as plated posts or grouted core-drilled footers are permissible only if shown by engineering analysis to be sufficient in strength for the intended application.

3.03 FENCE INSTALLATION MAINTENANCE

When cutting/drilling rails or posts adhere to the following steps to seal the exposed surfaces; 1) Remove all metal shavings from cut area. 2) Apply custom finish paint matching fence color. Failure to seal exposed surfaces per steps 1 & 2 above will negate warranty. Ameristar spray cans or paint pens shall be used to finish exposed surfaces; it is recommended that paint pens be used to prevent overspray. Use of non-Ameristar parts or components will negate the manufactures' warranty.

3.04 GATE INSTALLATION

Gate posts shall be spaced according to the manufacturers' gate drawings, dependent on standard out-to-out gate leaf dimensions and gate hardware selected. Type and quantity of gate hinges shall be based on the application; weight, height, and number of gate cycles. The manufacturers' gate drawings shall identify the necessary gate hardware required for the application. Gate hardware shall be provided by the manufacture of the gate and shall be installed per manufacturer's recommendations.

3.05 CLEANING

The contractor shall clean the jobsite of excess materials; post-hole excavations shall be scattered uniformly away from posts.

Table 1 – Minimum Sizes for Echelon Plus Posts			
Fence Posts	Panel Height		
2-1/2" x 2-1/2" x .060" w/ reinforced web	Up to 6' Height		
Gate Leaf	Gate Height		
	Up to & Including 4'	Over 4' Up to & Including 5'	Over 5' Up to & Including 6'
Up to 4'	2 1/2" x 2-1/2" x .060" Alum.	3" x 3" x .120" Alum.	4" x 4" x .250" Alum. or 3" x 3" x 12ga. Steel
4'1" to 6'	3" x 3" x .120" Alum.	4" x 4" x .250" Alum. or 3" x 3" x 12ga. Steel	3" x 3" x 12ga. Steel
6'1" to 8'	4" x 4" x .250" Alum. or 3" x 3" x 12ga. Steel	4" x 4" x 11ga. Steel	4" x 4" x 11ga. Steel

Table 2 – Coating Performance Requirements		
Quality Characteristics	ASTM Test Method	Performance Requirements
Adhesion	D3359 – Method B	Adhesion (Retention of Coating) over 90% of test area (Tape and knife test).
Corrosion Resistance	B117 & D1654	Corrosion Resistance over 1000 hours (Scribed per D1654; failure mode is accumulation of 1/8" coating loss from scribe or medium #8 blisters).
Impact Resistance	D2794	Impact Resistance over 60 inch lb. (Forward impact using 0.625" ball).
Weathering Resistance	D822, D2244, D523 (60˚ Method)	Weathering Resistance over 1,000 hours (Failure mode is 60% loss of gloss or color variance of more than 3 delta-E color units).

Table 3 – Echelon Plus – Post Spacing By Bracket Type					
Span	8' Nominal (91-3/4" Rail)				
Post Size	2-1/2"	2-1/2"	3"	2-1/2"	3"
Bracket Type	Echelon Plus Line Boulevard (ABB3)	Echelon Plus Swivel* (ABB2)		Echelon Plus Flat Mount (ABB1)	
Post Settings ± 1/2" O.C.	95"	*95"	*95-1/2"	95"	95-1/2"
Span	6' Nominal (73-1/16" Rail)				
Post Size	2-1/2"	2-1/2"	3"	2-1/2"	3"
Bracket Type	Echelon Plus Line Boulevard (ABB3)	Echelon Plus Swivel* (ABB2)		Echelon Plus Flat Mount (ABB1)	
Post Settings ± 1/2" O.C.	76-1/4"	*76-1/4"	*76-3/4"	76-1/4"	76-3/4"
*Note: When using ABB2 swivel brackets on either or both ends of a panel installation, care must be taken to ensure the spacing between post and adjoining pickets meets applicable codes. This will require trimming one or both ends of the panel.					

SECTION 04810 - UNIT MASONRY ASSEMBLIES

GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

This Section includes unit masonry assemblies consisting of the following:

- Concrete masonry units.
- Brick.
- Mortar and grout.
- Masonry joint reinforcement.
- Ties and anchors.
- Embedded flashing.
- Miscellaneous masonry accessories.

Related Sections include the following:

- Division 7 Section "Sheet Metal Flashing and Trim" for exposed sheet metal flashing.
- Division 7 Section "Firestopping" for firestopping at tops of masonry walls and at openings in masonry walls.

Products furnished, but not installed, under this Section include the following:

- Anchor sections of adjustable masonry anchors for connecting to structural frame, installed under Division 5 Section "Structural Steel."

Products installed, but not furnished, under this Section include the following:

- Steel lintels and shelf angles for unit masonry, furnished under Division 5 Section "Metal Fabrications."
- Manufactured reglets in masonry joints for metal flashing, furnished under Division 7 Section "Sheet Metal Flashing and Trim."
- Hollow-metal frames in unit masonry openings, furnished under Division 8 Section "Steel Doors and Frames."

1.3 DELIVERY, STORAGE, AND HANDLING

Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

Protect Type I concrete masonry units from moisture absorption so that, at the time of installation, the moisture content is not more than the maximum allowed at the time of delivery.

Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.4 PROJECT CONDITIONS

Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

Protect base of walls from rain-splashed mud and from mortar splatter by coverings spread on ground and over wall surface.

Protect sills, ledges, and projections from mortar droppings.

Protect surfaces of window and doorframes, as well as similar products with painted and integral finishes, from mortar droppings.

Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40° F (4 ° C) and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.

When ambient temperature exceeds 100° F (38° C), or 90° F (32° C) with a wind velocity greater than 8 mph (13 km/h), do not spread mortar beds more than 48 inches (1200 mm) ahead of masonry. Set masonry units within one minute of spreading mortar.

PRODUCTS

1.5 CONCRETE MASONRY UNITS

General: Provide shapes indicated and as follows:

Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.

Provide bullnose units for outside corners, unless otherwise indicated.

Concrete Masonry Units: ASTM C 90 and as follows:

Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.

Building Brick: ASTM C 55 and as follows:

Weight Classification: Normal weight.

Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.

1.6 BRICK

1.7 MORTAR AND GROUT MATERIALS

Masonry Cement: ASTM C 91.

Water: Potable.

1.8 MASONRY JOINT REINFORCEMENT

General: ASTM A 951 and as follows:

Hot-dip galvanized, carbon-steel wire for both interior and exterior walls.

Wire Size for Side Rods: W2.8 or 0.188-inch (4.8-mm) diameter.

Wire Size for Cross Rods: W1.7 or 0.148-inch (3.8-mm) diameter.

Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units where indicated.

For single-wythe masonry, provide either ladder or truss type with single pair of side rods and cross rods spaced not more than 16 inches (407 mm) o.c.

1.9 TIES AND ANCHORS, GENERAL

General: Provide ties and anchors, specified in subsequent articles, made from materials that comply with this Article, unless otherwise indicated.

Hot-Dip Galvanized Carbon-Steel Wire: ASTM A 82 with ASTM A 153, Class B-2 coating.

Steel Sheet, Galvanized after Fabrication: ASTM A 366/A 366M cold-rolled, carbon-steel sheet hot-dip galvanized after fabrication to comply with ASTM A 153.

1.10 BENT WIRE TIES

General: Rectangular units with closed ends and not less than 4 inches (100 mm) wide. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches (50 mm) long may be used for masonry constructed from solid units or hollow units laid with cells horizontal.

Wire: Fabricate from 3/16-inch- (4.8-mm-) diameter, hot-dip galvanized steel wire.

1.11 ADJUSTABLE ANCHORS FOR CONNECTING TO STEEL FRAME

General: Provide two-piece assemblies that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

Anchor Section: Crimped 1/4-inch- (6.4-mm-) diameter, hot-dip galvanized steel wire anchor section for welding to steel.

Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch (25 mm) of masonry face, made from 0.25-inch- (6.4-mm-) diameter, hot-dip galvanized steel wire.

1.12 ANCHORS FOR CONNECTING TO CONCRETE

General: Provide two-piece assemblies that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

Anchor Section: Dovetail anchor section formed from 0.0966-inch- (2.5-mm-) thick, steel sheet, galvanized after fabrication.

Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch (25 mm) of masonry face, made from 0.25-inch- (6.4-mm-) diameter, hot-dip galvanized steel wire.

1.13 MISCELLANEOUS EMBEDDED FLASHING MATERIALS

Metal Flashing: Fabricate from the following metal complying with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim" and below:

Stainless Steel: 0.0156 inch (0.4 mm) thick, or

Copper: 10-oz./sq. ft. (3-kg/sq. m) weight or 0.0135 inch (0.34 mm) 16-oz./sq. ft. (5-kg/sq. m) weight or 0.0216 inch (0.55 mm) thick elsewhere.

Fabricate metal expansion-joint strips from sheet metal indicated above, formed to shape indicated.

Fabricate metal drip edges from sheet metal indicated above. Extend at least 3 inches into wall and 1/2 inch (13 mm) out from wall, with a hemmed outer edge bent down 30 degrees.

Contractor's Option for Concealed Flashing: For flashing partly exposed to the exterior, use metal flashing specified above. For flashing not exposed to the exterior, use one of the following, unless otherwise indicated:

Copper-Laminated Flashing: Manufacturer's standard laminated flashing consisting of 5-oz./sq. ft. (1.5-kg/sq. m) sheet copper bonded with asphalt between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.

Asphalt-Coated Copper Flashing: Manufacturer's standard product consisting of 5-oz./sq. ft. (1.5-kg/sq. m) sheet copper coated with flexible asphalt. Use only where flashing is fully concealed in masonry.

Rubberized-Asphalt Flashing: Manufacturer's standard composite flashing product consisting of a pliable and highly adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of 0.030 inch (0.8 mm).

Elastomeric Thermoplastic Flashing: Manufacturer's standard composite flashing product consisting of a polyester-reinforced ethylene interpolymer alloy 0.025 inch (0.6 mm) thick with a 0.015-inch- (0.4-mm-) thick layer of rubberized-asphalt adhesive.

Provide flashing as a complete system with preformed corners, end dams, other special shapes, and seaming materials; all produced by flashing sheet manufacturer.

EPDM Flashing: Manufacturer's standard flashing product formed from a terpolymer of ethylene-propylene diene, complying with ASTM D 4637, 0.040 inch (1.0 mm) thick.

Solder and Sealants for Sheet Metal Flashings: As specified in Division 7 Section "Sheet Metal Flashing and Trim."

Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by the flashing manufacturer for bonding flashing sheets to each other and to substrates.

Products: Subject to compliance with requirements, provide one of the following:

Metal Flashing:

Cheney Flashing (Dovetail); Cheney Flashing Company, Inc.
Cheney Flashing (Sawtooth); Cheney Flashing Company, Inc.
Keystone 3-Way Interlocking Thruwall Flashing; Keystone Flashing Co.

Copper-Laminated Flashing:

Copper Fabric Flashing; Advanced Building Products, Inc.
Copper Fabric; AFCO Products, Inc.
H & B C-Fab Flashing; Hohmann & Barnard, Inc.
Type FCC-Fabric Covered Copper; Phoenix Building Products.
Copper Fabric Flashing; Polytite Manufacturing Corp.
Copper Fabric Flashing; Sandell Manufacturing Co., Inc.
York Copper Fabric Flashing; York Manufacturing, Inc.

Asphalt-Coated Copper Flashing:

Cop-R-Cote; Advanced Building Products, Inc.
Cop-A-Cote; AFCO Products, Inc.
H & B C-Coat Flashing; Hohmann & Barnard, Inc.
Type ACC-Asphalt Bituminous Coated; Phoenix Building Products.
Coated Copper Flashing; Polytite Manufacturing Corp.
Coated Copper Flashing; Sandell Manufacturing Co., Inc.
Copperseal; York Manufacturing, Inc.

Rubberized-Asphalt Flashing:

Dur-O-Barrier; Dur-O-Wal, Inc.
Perm-A-Barrier Wall Flashing; W. R. Grace & Co., Construction Products Division.
Textroflash; Hohmann & Barnard, Inc.
Poly-Barrier Self-Adhering Wall Flashing; Polytite Manufacturing Corp.
Polyguard 300; Polyguard Products, Inc.
Everlastic MF-40; Williams Products, Inc.

Elastomeric Thermoplastic Flashing:

Hyload Flashing Membrane; Hyload Cloaked Flashing System.

EPDM Flashing:

FlashGuard; Firestone Building Products.

1.14 MISCELLANEOUS MASONRY ACCESSORIES

Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene urethane or PVC.

Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

Wicking Material: polyester rope, 1/4 to 3/8 inch (6 to 10 mm) in diameter, in length required producing 2-inch (50-mm) exposure on exterior and 18 inches (450 mm) in cavity between wythes.

Cavity Drainage Material: 1-inch- (25-mm-) thick, free-draining mesh; made from polyethylene strands and shaped to avoid being clogged by mortar droppings.

Products: Subject to compliance with requirements, provide one of the following:
Cavity Drainage Material:
Mortar Break; Advanced Building Products, Inc.
CavClear Masonry Mat; CavClear.
Mortar Net; Mortar Net USA, Ltd.
Mortar Stop; Polytite Manufacturing Corp.

1.15 MASONRY CLEANERS

Job-Mixed Detergent Solution: Solution of 1/2-cup (0.14-L) dry measure tetrasodium polyphosphate and 1/2-cup (0.14-L) dry measure laundry detergent dissolved in 1 gal. (4 L) of water.

1.16 MORTAR AND GROUT MIXES

General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
Do not use calcium chloride in mortar or grout.

Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in the form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

Mortar for Unit Masonry: Comply with BIA M1, Property Specification.
For masonry below grade, in contact with earth, and where indicated, use Type M.
For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.

Grout for Unit Masonry: Comply with ASTM C 476.
Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 5 of ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143.

EXECUTION

1.17 EXAMINATION

Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
Verify that foundations are within tolerances specified.
Proceed with installation only after unsatisfactory conditions have been corrected or ameliorated.

Before installation, examine rough-in and built-in construction to verify actual locations of piping connections.

1.18 INSTALLATION, GENERAL

Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual widths of masonry units, using units of widths indicated.

Build chases and recesses to accommodate items specified in this Section and in other Sections of the Specifications.

Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to the opening.

Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide a continuous pattern and to fit adjoining construction. Where possible, use full-size units without cutting. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
Mix units from several pallets or cubes as they are placed.

1.19 CONSTRUCTION TOLERANCES

Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and the following:

For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/4 inch in 20 feet (6 mm in 6 m), nor 1/2 inch (12 mm) maximum.

For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), nor 1/2 inch (12 mm) maximum.

For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than 1/4 inch in 20 feet (6 mm in 6 m), nor 1/2 inch (12 mm) maximum.

For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm). Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).

For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).

1.20 LAYING MASONRY WALLS

Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
Running bond or as indicated otherwise on Drawings.

Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches (50 mm). Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

Stopping and Resuming Work: In each course, rack back one-half-unit length for one-half running bond or one-third-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar before laying fresh masonry.

Built-in Work: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

Fill space between hollow-metal frames and masonry solidly with mortar, unless otherwise indicated.

Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.

Fill cores in hollow concrete masonry units with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.

At fire-rated partitions, install firestopping in joint between top of partition and underside of structure above to comply with Division 7 Section "Firestopping."

1.21 MORTAR BEDDING AND JOINTING

Lay hollow masonry units as follows:

With full mortar coverage on horizontal and vertical face shells.

Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.

For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.

Lay solid brick-size masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than the joint thickness, unless otherwise indicated.

Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

1.22 MASONRY JOINT REINFORCEMENT

General: Provide continuous masonry joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).

Space reinforcement not more than 16 inches (406 mm) o.c.

Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.

Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) minimum beyond openings.

Reinforcement above is in addition to continuous reinforcement.

Cut or interrupt joint reinforcement at control and expansion joints.

Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

1.23 ANCHORING MASONRY TO STRUCTURAL MEMBERS

Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:

Provide an open space not less than 1 inch (25 mm) in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar or other rigid materials.

Anchor masonry to structural members with flexible anchors embedded in masonry joints and attached to structure.

Space anchors as indicated, but not more than 24 inches (610 mm) o.c. vertically and 36 inches (915 mm) o.c. horizontally.

1.24 CONTROL AND EXPANSION JOINTS

General: Install control and expansion joints in unit masonry where indicated. Build-in related items as masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.

Form control joints in concrete masonry as follows:

Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake joint.

Form expansion joints in brick made from clay or shale as follows:

Form open joint of width indicated, but not less than 3/8 inch (10 mm) for installation of sealant and backer rod specified in Division 7 Section "Joint Sealants." Keep joint free and clear of mortar.

Build in horizontal, pressure-relieving joints where indicated; construct joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 7 Section "Joint Sealants."

Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry veneer and attached to structure behind masonry veneer.

1.25 LINTELS

Install steel lintels where indicated.

Provide precast lintels made from concrete matching concrete masonry units in color, texture, and compressive strength and with reinforcing bars indicated or required to support loads indicated. Cure precast lintels by the same method used for concrete masonry units.

Provide minimum bearing of 8 inches (200 mm) at each jamb, unless otherwise indicated.

1.26 FLASHING, WEEP HOLES, AND VENTS

General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Unless otherwise indicated, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.

Install flashing as follows:

At multi-wythe masonry walls, including cavity walls, extend flashing from exterior face of outer wythe of masonry, through outer wythe, turned up a minimum of 4 inches (100 mm), and through inner wythe to within 1/2 inch (13 mm) of the interior face of the wall in exposed masonry. Where interior surface of inner wythe is concealed by furring, carry flashing completely through inner wythe and turn flashing up approximately 2 inches (50 mm), unless otherwise indicated.

At masonry-veneer walls, extend flashing from exterior face of veneer, through veneer, up face of sheathing at least 8 inches (200 mm), and behind air-infiltration barrier or building paper.

At lintels and shelf angles, extend flashing a minimum of 4 inches (100 mm) into masonry at each end. At heads and sills, extend flashing 4 inches (100 mm) at ends and turn flashing up not less than 2 inches (50 mm) to form a pan.

Extend sheet metal flashing 1/2 inch (13 mm) beyond face of masonry at exterior and turn flashing down to form a drip.

Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

Install weep holes in the head joints in exterior wythes of the first course of masonry immediately above embedded flashing and as follows:

Use wicking material to form weep holes.

Space weep holes 24 inches (600 mm) o.c.

Trim wicking material used in weep holes flush with outside face of wall after mortar has set.

Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

1.27 REPAIRING, POINTING, AND CLEANING

Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application.

In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.

Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.

Clean brick by the bucket-and-brush hand-cleaning method described in BIA Technical Notes No. 20, using job-mixed detergent solution.

Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2 applicable to type of stain on exposed surfaces.

1.28 MASONRY WASTE DISPOSAL

Recycling: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

Disposal as Fill Material: Dispose of clean masonry waste, including broken masonry units, waste mortar, and excess or soil-contaminated sand, by crushing and mixing with fill material as fill is placed.

Crush masonry waste to less than 4 inches (100 mm) in each dimension.

Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Division 2 Section "Earthwork."

Do not dispose of masonry waste as fill within 24 inches (450 mm) of finished grade.

Excess Masonry Waste: Remove excess, clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

SECTION 05500 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Miscellaneous steel trim.
   2. Pipe bollards.

1.2 SUBMITTALS

A. Shop Drawings: Include plans, elevations, sections, details of installation, and attachments to other Work.

PART 2 - PRODUCTS

2.1 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces without blemishes.

B. Ferrous Metals:
   1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
   2. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500.
   3. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
   4. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either ASTM A 47(ASTM A 47M) malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

C. Aluminum:
   1. Extrusions: ASTM B 221(ASTM B 221M), alloy 6063-T6.
   2. Alloy Rolled Tread Plate: ASTM B 632/B 632M, alloy 6061-T6.

2.2 PAINT

A. Galvanizing Repair Paint: SSPC-Paint 20, high-zinc-dust-content paint for regalvanizing welds in steel.

2.3 MISCELLANEOUS MATERIALS

A. Fasteners: Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls, of type, grade, and class required by application indicated.

B. Non-shrink, Nonmetallic Grout: ASTM C 1107, factory-packaged, non-staining, non-corrosive, nongaseous grout.

C. Concrete Fill: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi(20 MPa), unless otherwise indicated.
   1. Drill for mechanical anchors and countersink. Locate not more than 4 inches (100 mm) from ends and not more than 12 inches (300 mm) o.c.

2.4 FABRICATION

A. Connections, General: Use connections that maintain structural value of joined pieces.
   1. Shear and punch metals cleanly and accurately. Remove burrs.

2. Weld corners and seams continuously. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Obtain fusion without undercut or overlap. Remove welding flux immediately. Finish exposed welds smooth and blended.
3. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes.
4. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.

B. Miscellaneous Steel Trim: Fabricate units with continuously welded joints and smooth exposed edges. Miter corners and use concealed splices where possible. Fabricate cutouts, fittings, and anchorages; coordinate assembly and installation with other work.

C. Pipe Guards: 3-by-3-by-5/16-inch(76-by-76-by-8-mm) steel angles, extending from floor to 42 inches(1100 mm) above floor, with 3/8-inch(10-mm) steel base plates for bolting to floor. Provide at least two vertical angles at each location. Connect tops of angles and anchor to wall or column with 1/4-by-2-inch(6-by-50-mm) steel strap braces welded to angles and bolted to wall.

D. Pipe Bollards: Fabricate from Schedule 40 steel pipe.

2.5 FINISHES

A. Finish metal fabrications after assembly. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
1. Hot-dip galvanize all items to comply with ASTM A 123 or ASTM A 153/A 153M as applicable.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Provide anchorage devices and fasteners for securing metal fabrications to in-place construction. Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, with edges and surfaces level, plumb, and true.
1. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
2. Fit exposed connections accurately together. Weld connections, unless otherwise indicated. Do not weld, cut, or abrade galvanized surfaces.

B. Touch up surfaces and finishes after erection.
1. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 06100 - ROUGH CARPENTRY

PART 1 - General

1.1 Summary

A. This Section Includes The Following:
   1. Wood Blocking.
   2. Wood Nailers.
   3. Wood Grounds.
   4. Plywood Backing Panels.

1.2 Submittals

A. Product Data: For Each Type Of Process And Factory-Fabricated Product Indicated.
   1. Include Data For Wood-Preservative And Fire-Retardant Treatment From Chemical Treatment Manufacturer And Certification By Treating Plant That Materials Comply With Requirements.

PART 2 - PRODUCTS

2.1 Wood Products, General

A. Lumber: Doc Ps 20 And Applicable Rules Of Lumber Grading Agencies Certified By The American Lumber Standards Committee Board Of Review.
   1. Factory Mark Each Piece Of Lumber With Grade Stamp Of Grading Agency.
   2. Provide Dressed Lumber, S4s, Unless Otherwise Indicated.
   3. Provide Dry Lumber With 19 Percent Maximum Moisture Content At Time Of Dressing For 2-Inch Nominal (38-Mm Actual) Thickness Or Less, Unless Otherwise Indicated.
   4. Do not use lumber that exhibits mold or mildew, replace any lumber that exhibits mold or mildew during construction.

B. Engineered Wood Products: Acceptable To Authorities Having Jurisdiction And For Which Current Model Code Research Or Evaluation Reports Exist That Show Compliance With Building Code In Effect For Project.
   1. Allowable Design Stresses: Meet Or Exceed Those Indicated Per Manufacturer's Published Values Determined From Empirical Data Or By Rational Engineering Analysis And Demonstrated By Comprehensive Testing Performed By A Qualified Independent Testing Agency.

C. Wood Structural Panels:
   1. Plywood: Either Doc Ps 1 Or Doc Ps 2, Unless Otherwise Indicated.
   2. Oriented Strand Board: Doc Ps 2.

2.2 Wood-Preservative-Treated Materials

A. Preservative Treatment By Pressure Process: Awpa C2 (Lumber) And Awpa C9 (Plywood), Except That Lumber That Is Not In Contact With The Ground And Is Continuously Protected From Liquid Water May Be Treated According To Awpa C31 With Inorganic Boron (Sbx).

B. Kiln-Dry Material After Treatment To A Maximum Moisture Content Of 19 Percent For Lumber And 15 Percent For Plywood.

C. Mark Each Treated Item With Treatment Quality Mark Of An Inspection Agency Approved By The American Lumber Standards Committee Board Of Review.

D. Application: Treat Items Indicated On Drawings, And The Following:

1. Wood Cants, Nailers, Curbs, Equipment Support Bases, Blocking, Stripping, And Similar Members In Connection With Roofing, Flashing, Vapor Barriers, And Waterproofing.
2. Wood Sills, Sleepers, Blocking, Furring, Stripping, And Similar Concealed Members In Contact With Masonry Or Concrete.
3. Wood Floor Plates That Are Installed Over Concrete Slabs Directly In Contact With Earth.

2.3 Fire-Retardant-Treated Materials

A. General: All Wood Blocking And Miscellaneous Wood Framing In The Clubhouse And Elsewhere In The Residential Buildings Where Fire-Retardant-Treated Materials Are Indicated, Provide Materials That Comply With Performance Requirements In Awpa C20 (Lumber) And Awpa C27 (Plywood). Identify Fire-Retardant-Treated Wood With Appropriate Classification Marking Of Ul, U.S. Testing, Timber Products Inspection, Or Another Testing And Inspecting Agency Acceptable To Authorities Having Jurisdiction.
   1. Use Treatment For Which Chemical Manufacturer Publishes Physical Properties Of Treated Wood After Exposure To Elevated Temperatures, When Tested By A Qualified Independent Testing Agency According To Astm D 5664, For Lumber And Astm D 5516, For Plywood.
   2. Use Treatment That Does Not Promote Corrosion Of Metal Fasteners.
   3. Use Exterior Type For Exterior Locations And Where Indicated.
   4. Use Interior Type A High Temperature (Ht), Unless Otherwise Indicated.

2.4 Dimension Lumber

A. General: Of Grades Indicated According To The American Lumber Standards Committee National Grading Rule Provisions Of The Grading Agency Indicated.

2.5 Plywood Backing Panels

A. Telephone And Electrical Equipment Backing Panels: Doc Ps 1, Exposure 1, C-D Plugged, Fire-Retardant Treated, In Thickness Indicated Or, If Not Indicated, Not Less Than 1/2 Inch(12.7 Mm) Thick.

2.6 Miscellaneous Materials

A. Fasteners:
   1. Where Rough Carpentry Is Exposed To Weather, In Ground Contact, Or In Area Of High Relative Humidity, Provide Fasteners With Hot-Dip Zinc Coating Complying With Astm A 153/A 153m.
   2. Power-Driven Fasteners: Cabo Ner-272.
   3. Bolts: Steel Bolts Complying With Astm A 307, Grade A(Astm F 568m, Property Class 4.6) With Astm A 563(Astm A 563m) Hex Nuts And, Where Indicated, Flat Washers.

B. Sill-Sealer Gaskets: Glass-Fiber-Resilient Insulation, Fabricated In Strip Form, For Use As A Sill Sealer; 1-Inch(25-Mm) Nominal Thickness, Compressible To 1/32 Inch(0.8 Mm); Selected From Manufacturer's Standard Widths To Suit Width Of Sill Members Indicated.

C. Adhesives For Field Gluing Panels To Framing: Formulation Complying With Apa Afg-01 Or Astm D 3498 That Is Approved For Use With Type Of Construction Panel Indicated By Both Adhesive And Panel Manufacturers.

PART 3 - EXECUTION

3.1 Installation

A. Set Rough Carpentry To Required Levels And Lines, With Members Plumb, True To Line, Cut, And Fitted. Fit Rough Carpentry To Other Construction; Scribe And Cope As Needed For Accurate Fit.

Locate Furring, Nailers, Blocking, Grounds, And Similar Supports To Comply With Requirements For Attaching Other Construction.

B. Apply Field Treatment Complying With Awpa M4 To Cut Surfaces Of Preservative-Treated Lumber And Plywood.

C. Securely Attach Rough Carpentry Work To Substrate By Anchoring And Fastening As Indicated, Complying With The Following:
   1. Cabo Ner-272 For Power-Driven Fasteners.
   2. Published Requirements Of Metal Framing Anchor Manufacturer.
   3. Table 2306.1, "Fastening Schedule," In The Standard Building Code (Sbcci).

D. Framing Standard: Comply With Afpa's "Manual For Wood Frame Construction," Unless Otherwise Indicated.

E. Framing With Engineered Wood Products: Install Engineered Wood Products To Comply With Manufacturer's Written Instructions.

F. Comply With Applicable Recommendations Contained In Apa Form No. E30k, "Apa Design/Construction Guide: Residential & Commercial," For Types Of Structural-Use Panels And Applications Indicated.

G. Fastening Methods:
   1. Plywood Backing Panels: Nail Or Screw To Supports.

End of Section

SECTION 06105 – MISCELLANEOUS CARPENTRY

1.1 GENERAL

A. Submittals: Submit wood treatment data, including chemical treatment manufacturer's instructions for handling, storing, installing, and finishing treated materials.

1.2 PRODUCTS

A. Lumber, General: Comply with DOC PS 20 and with applicable grading rules of inspection agencies certified by the American Lumber Standards Committee's (ALSC) Board of Review. Provide dressed lumber, S$S, with each piece factory marked with grade stamp of inspection agency.
   1. For exposed lumber, furnish pieces with grade stamps applied to ends or back of each piece, or omit grade stamps and provide grade-compliance certificates issued by inspection agency
   2. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.
   3. Provide lumber with 15 percent maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.
   4. Do not use and remove any lumber which exhibits mold or mildew growth. Replace and any point in construction where mold or mildew appears on lumber products.

B. Wood-Preservative-Treated Materials: Comply with applicable requirements of AWPA C (Lumber) and AWPA C9 (Plywood). Mark each treated item with the Quality Mark Requirements of an inspection agency approved by ALSC'S Board of Review.
   1. Pressure treat above ground items with waterborne preservatives to a minimum retention of .25 lb/cu ft. 94.0 kg/cu m). After treatment, kiln-dry lumber and plywood to a maximum moisture content of 19 and 15 percent, respectively. Treat indicated items and the following:
      a. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and water-proofing.
      b. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
      c. Wood framing members less than 18 inches (460 mm) above grade.
      d. Wood floor plates installed over concrete slabs directly in contact with earth.
   1. Pressure treat wood members in contact with ground or freshwater with waterborne preservatives to a minimum retention of 0.40 lb/cu ft (6.4 kg/cu. M)

C. Fire-Retardant-Treated Materials: Comply with applicable requirements of AWPA C20 (lumber) and AWPA C27 (plywood). Identify fire-retardant-treated wood with appropriate classification marking of UL; U.S. Testing; Timber Products Inspection, Inc.; or another testing and inspecting agency acceptable to authorities having jurisdiction.

D. Dimension Lumber: Provide dimension lumber of grades indicated according to the ALSC National Grading Rule (NGR) provisions of the inspection agency indicated.
   1. Interior Partitions: Provide Standard, Stud, or No. 3 grade and any of the following species:
      a. Species: Eastern softwoods; NELMA
      b. Species: Northern species; NLGA
      c. Species: Mixed southern pine; SPIB
      d. Species: Western woods: WCLIB or WWPA
   2. Other Framing: Provide Construction or No. 2 grade and any of the following species:
      a. Species: Spruce-pine-fir; NELMA or NLGA
      b. Species: Southern pine; SPIB.
      c. Species: Douglas fir-larch; NLGA, WCLIB, or WWPA
      d. Species: Hem-fir; NLGA, WCLIB, or WWPA
      e. Species: Douglass fir south; WWPA

E. Exposed Boards: Provide lumber with 19 percent maximum moisture content and any of the following species and grades:
   1. Species and Grade: Eastern white pine, D Select per NELMA or NLGA rules.
   2. Species and Grade: Western or Idaho white pine, Choice per NLGA or WWPA rules

F. Concealed Boards: Provide lumber with 19 percent maximum moisture content and any of the following species grades:

1. Species and Grade: Eastern softwoods, No.3 Common per NELMA rules.
2. Species and Grade: Northern species, No. 3 Common or Standard per NLGA rules.
3. Species and Grade: Mixed southern pine, No. per SPIB rules.
4. Species and Grade: Western woods, Standard per WCLIB rules or No. 3 Common per WWPA rules.

G. Interior Softwood Trim: Provide finished lumber and moldings complying with the following requirements including those of the grading agency listed with species:
   1. Species: Eastern white pine; NELMA or Idaho white, lodge pole, ponderosa, or sugar pine; WWPA
   2. Grade: B & Br Select or Supreme

H. Wood Molding Patterns: Provide stock moldings indicated, made to pattern included in WMMPA WM & and graded under WMMPA WM 4.
   1. Moldings for Transparent Finish: N-Grade

I. Shelving and clothes Rods: Provide 1-inch nominal – (19-mm actual) thickness boards of species and grade indicated above for exposed boards and 1-1/2 inch-(38-mm) diameter clear, kiln-dried hardwood rods.

J. Wood-Based Structural-Use Panel; Provide either all-veneer, amt-formed, or composite panels complying with DOC PS 2,"Performance Standard for Wood –Base Structural-Use Panels," unless otherwise indicated. Provide plywood panels complying with DOC PS 1, "U.S. Product Standard for Construction and Industrial Plywood," where plywood is indicated.
   1. Trademark: Factory mark structural-use panels with APA trademark evidencing compliance with grade requirements.
   2. Miscellaneous Concealed Plywood: C-C Plugged Exterior, thickness as indicated but not less than 1/2 inch (12.7 mm)
   3. Miscellaneous Exposed Plywood: A-D Interior, thickness as indicated but not less than ½ inch (12.7 mm)
   4. Plywood Backing Panels: For mounting electrical or telephone equipment, provide fire-retardant-treated plywood panels with grade, C-D Plugged Exposure 1, in thickness indicated or, if not otherwise indicated, not less than 15/32 inch (11.9mm) thick.

K. Particleboard: Comply with a factory mark each panel according to ANSI A208.1. Provide thickness indicated
   1. Particleboard Underlayment: Grade PBU.

L. Hardboard underlayment: ANSI/AHA A135.4, Class 4 (Service), Surface SIS; with back side sanded to produce boards with uniform thickness of 0.215 or 0.200 inch (5.5 or 5mm), as standard with manufacturer, plus or minus 0.500 inch (0.13mm).

M. Fasteners: Size and type indicated. Where miscellaneous carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot0dip zinc coating ASTM A 153 or Type stainless steel
   1. Power-Driven fasteners: CABO NER – 272

1.3 EXECUTION

A. Set carpentry to required level and lines, with members plumb, true to line, cut, and fitted.

B. Fit carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, locking, grounds, and similar supports to allow attachments of other construction.

C. Securely attach carpentry work as indicated and according to applicable codes and recognized standards.

D. Countersink nail heads on exposed carpentry work and fill holes with wood filler.

E. Installation of 'Structural-Use Panels: Comply with applicable recommendations contained in APA Form No. E30, "APA Design/Construction Guide: Residential & Commercial," for types of structural-use panels and applications indicated.

F. Install wood trim with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Cope at returns and mitter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints
   1. Match color and grain pattern across joints.
   2. Install trim after gypsum board joint finishing operations are completed.
   3. Install to tolerance of 1/8 inch 96 inches (3 mm in 2400 mm) for plumb and level. Install adjoining trim with 1/32-inch (.08-mm) maximum offset for flush installation and 1/16-inch (1.6-mm) maximum offset for reveal installation.

END OF SECTION

SECTION 06 16 13 – INSULATING SHEATHING (ZIP System R Sheathing)

GENERAL

1.1 SUMMARY

A. Section includes insulating wall sheathing with integral water-resistive barrier and air barrier.

1.2 REFERENCES

A. American Society of Mechanical Engineers (ASME): www.asme.org

1. ASME B18.6.1 - Wood Screws (Inch Series)

B. ASTM International (ASTM): www.astm.org

1. ASTM A153/A153M - Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
2. ASTM C1289 - Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
3. ASTM D779 - Test Method for Water Resistance of Paper, Paperboard, and Other Sheet Materials by the Dry Indicator Method
4. ASTM D1621 - Test Method for Compressive Properties Of Rigid Cellular Plastics
5. ASTM D2247 - Practice for Testing Water Resistance of Coatings in 100% Relative Humidity
6. ASTM E96/E 96M - Test Methods for Water Vapor Transmission of Materials
7. ASTM E331 - Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
8. ASTM E2357 - Test Method for Determining Air Leakage of Air Barrier Assemblies
9. ASTM F1667 - Specification for Driven Fasteners: Nails, Spikes, and Staples
10. ASTM G154 - Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials

C. US Department of Commerce (DOC): http://gsi.nist.gov/global/index.cfm/L1-5/l2-44/A-355

1. DOC PS 2 - Performance Standard for Wood-Based Structural Panels

D. International Code Council (ICC): www.iccsafe.org

1. ICC IBC - International Building Code
2. ICC IRC - International Residential Code for One and Two-Family Dwellings

E. ICC Evaluation Service, Inc. (ICC-ES): www.icc-es.org

1. ICC-ES AC12 - Acceptance Criteria For Foam Plastic Insulation
2. ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers
3. ICC-ES AC116 - Acceptance Criteria for Nails and Spikes
4. ICC-ES AC148 - Acceptance Criteria For Flexible Flashing Materials
5. ICC-ES AC201 - Acceptance Criteria for Staples
6. ICC-ES AC269 - Acceptance Criteria for Racking Shear Evaluation of Proprietary Sheathing Materials attached to Light-Frame Wall Construction or Code-Complying Sheathing Attached to Light-Framed Walls with Proprietary Fasteners
7. ICC-ES AC310 - Acceptance Criteria for Water-Resistive Membranes Factory-bonded to Wood-based Structural Sheathing, Used as Water-Resistive Barriers

8. ICC-ES ESR-1539 - Power Driven Staples and Nails for Use in Engineered and Non-Engineered Connections
9. ICC-ES NER-272 - Power Driven Staples and Nails for Use in All Types of Building Construction

1.3 ACTION SUBMITTALS

A. Product Data: For each type of sheathing product specified.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: From ICC-ES, for wood sheathing and seam tape.

B. Product Certifications: From manufacturer, indicating that sheathing products comply with ICC-ES AC269 and ICC-ES AC310.

1.5 CLOSEOUT SUBMITTALS

A. Warranty: Executed copy of manufacturer special warranties.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide wood products from manufacturer certified by SFI, FSC, or comparable sustainable forestry program acceptable to Architect.

B. Provide wall sheathing products meeting requirements for water-resistive barrier in accordance with ICC-ES AC310.

C. Provide wall sheathing products meeting requirements of ICC-ES AC269.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's written instructions for protection of sheathing products from weather prior to installation.

1.8 WARRANTY

A. Special Manufacturer's Warranty: Manufacturer's standard form in which sheathing manufacturer agrees to repair or replace sheathing products that demonstrate deterioration or failure under normal use due to manufacturing defects within warranty period specified, when installed according to manufacturer's instructions.

1. Warranty Period for Sheathing Products: 30 years following date of Substantial Completion.
2. Warranty Conditions: Special warranties exclude deterioration or failure due to structural movement resulting in stresses on sheathing products exceeding manufacturer's written specifications, or due to air or moisture infiltration resulting from cladding failure or mechanical damage.

PRODUCTS

1.9 MANUFACTURERS

A. Basis-of-Design Product: Provide sheathing products manufactured by Huber Engineered Woods LLC, Charlotte NC; Phone: (800) 933-9220; Website: www.zipsystem.com.

1.10 PERFORMANCE REQUIREMENTS

A. Air-Barrier Assembly Air Leakage: Less than 0.04 cfm/sq. ft. at 1.57 lbf/sq. ft. (0.2 L/s x sq. m at 75 Pa), per ASTM E2375.

B. Water-Vapor Permeance, Facer: Minimum 12 perms (689 ng/Pa x s x sq. m), ASTM E96/E96M.

C. Weather Exposure: Manufacturer warranty applies for maximum allowable exposure period of 180 days.

1.11 MATERIALS

A. Oriented Strand Board: DOC PS 2, made with binder containing no added urea formaldehyde.

B. Rigid Foam Plastic Insulating Board: Rigid polyisocyanurate foam core complying with ASTM C1289 Type II, Class 2, and ICC-ES AC12, with coated glass fiber facers on both sides, with the following characteristics:

1. Nominal Density: 2.0 pcf (32 kg/cu. m).
2. Compressive Strength, ASTM D1621: Not less than 20 psi (150 kPa).
3. Vapor Permeance, ASTM E96/E96M: Less than 1.0 perm.
4. Edge Configuration: Square finished.

1.12 COMPOSITE INSULATING WALL SHEATHING

A. Composite Insulating Wall Sheathing: Oriented-strand-board Exposure 1 sheathing 7/16 inch (11.1 mm) thick, with factory-laminated water-resistive barrier exterior facer, and with rigid foam plastic insulating board laminated to interior face.

1. Basis-of-Design Product: Provide **Huber Engineered Woods LLC; ZIP System R Sheathing**.
2. Span Rating and Performance Category of Sheathing Layer: Not less than 24/16; 7/16 Performance Category.

Specifier: Select option in "Thickness" paragraph below and corresponding option in "Thermal Resistivity" paragraph that follow. Thickness is total thickness of ZIP System sheathing layer and foam insulation layer.

3. Thickness: 1-1/2 inch
4. Thermal Resistivity (R Value): 3.6 deg F x h x sq. ft./Btu x in. at 75 deg F
5. Edge Profile: Square edge.
6. Exterior Facer: Medium-density, phenolic-impregnated polymer-modified sheet material meeting requirements for ASTM D779 Grade D weather-resistive barrier in accordance with ICC AC38 and AC310, with fastener spacing symbols on exterior facer for 16-inch and 24-inch on center spacing, with the following characteristics

a. Water Resistance of Coatings, ASTM D2247: Pass 14 day exposure test.
b. Moisture Vapor Transmission, ASTM E96: Not less than 12 perms.
c. Water Penetration, ASTM E331: Pass at 2.86 lbf/sq. ft..
d. Wind Driven Rain, TAS-100: Pass.
e. Accelerated Weathering, ASTM G154: Pass.

1.13 FASTENERS

A. Fasteners, General: Size and type complying with manufacturer's written instructions for Project conditions and requirements of authorities having jurisdiction.

1. Corrosion Resistance: Hot-dip zinc coating, ASTM A153/A 153M

B. Nails, Brads, and Staples: ICC AC116 and ICC AC201.

C. Power-Driven Fasteners: ICC-ES-1539 or NER-272.

D. Wood Screws: ASME B18.6.1.

1.14 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIAL

A. Self-Adhering Seam and Flashing Tape: Pressure-sensitive, self-adhering, cold-applied, seam tape consisting of polyolefin film with acrylic adhesive, meeting ICC AC148.

1. Basis-of-Design Product: Provide **Huber Engineered Woods; ZIP System Tape**.
2. Thickness: 0.012 inch (0.3 mm).

EXECUTION

1.15 EXAMINATION

A. Examine framing spacing and alignment to determine if work is ready to receive sheathing. Proceed with sheathing work once conditions meet requirements.

1.16 SHEATHING INSTALLATION

A. Install sheathing panels in accordance with manufacturer's written instructions, requirements of applicable Evaluation Reports, and requirements of authorities having jurisdiction.

B. Air and Moisture Barrier: Coordinate sheathing installation with flashing and joint sealant installation and with adjacent building air and moisture barrier components to provide complete, continuous air- and moisture- barrier.

C. Do not bridge expansion joints; allow joint spacing equal to spacing of structural supports.

D. Install panels with laminated facer to exterior. Stagger end joints of adjacent panel runs.

E. Attach sheathing panels securely to substrate with manufacturer-approved fasteners in compliance with the following:

1. ICC-ES ESR-1539 or ICC-NES NER-272 for power-driven fasteners.
2. IBC: Table 2304.9.1 Fastening Schedule.

F. Apply seam tape at all panel seams, penetrations, and facer defects or cracks to form continuous weathertight surface. Apply tape according to manufacturer's written instructions and requirements of ICC-ES applicable to tape application.

END OF SECTION

SECTION 06200 - FINISH CARPENTRY

PART 1 - GENERAL

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Lumber Standards: DOC PS 20 and grading rules of inspection agencies certified by American Lumber Standards Committee board of Review.
B. Softwood Plywood: DOC PS 1.
C. Hardwood Plywood: HPVA HP-1.

2.02 STANDING AND RUNNING TRIM

A. Exterior Lumber Trim: Smooth-texture, B&B, southern yellow pine.
B. Exterior Primed Hardboard Trim: High-temperature cured, high-resin, wood fiber composite; factory primed; and recommended by manufacturer for exterior use.
C. Interior Trim: C Select, eastern white pine; B & Btr. Select or Supreme, Idaho white, lodge pole, ponderosa, or sugar pine.
D. Wood Molding Patterns: Stock moldings made to patterns in WMMPA WM 7 and graded under WMMPA WM 4, N-grade for transparent finish, P-Grade for painted finish.
   1. Base: WM 623, ogee bas.
   2. Casing: WM 327, clamshell casing.
   3. Shoe Mold: clear, kiln-dried red oak, WM 126, 1/2-by-3/4-inch quarter-round shoe.
E. Shelving: 3/4-inch plywood with radiuses and filled front edge.

2.03 PANELING

A. Hardwood Veneer Plywood Paneling: Manufacturer's stock panels complying with HPVA HP-1. Face Veneer species: Rotary-cut natural birch.
   2. Thickness: 1/4 inch.
B. Hardboard Paneling: Factory finished, 1/4 inch thick, complying with ANSI/AHA 135.5, Class I finish.
C. Board Paneling; southern yellow pin; V-joint, tongue and groove, PT 82 pattern; beaded ceiling, PT 85 patter; complying with WMMPA WM 9.
D. Gypsum Board Joint Treatment Materials: Comply with ASTM C 475. Paper reinforcing tape and drying-tape, ready-mixed, separate taping and topping compound.

PART 3 - EXECUTION

3.01 INSULATION

A. Condition finish carpentry in installation areas for 24 hours before installing.
B. Prime and back prime lumber for painted finish exposed on the exterior.
C. Install finish carpentry level, plumb, true, and aligned with adjacent materials. Scribe and cut to fit adjoining work. Refinish and seal cuts.
D. Install finish standing and running trim with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Stagger joints in adjacent and related trim. Cope at returns and miter at corners.
E. Select and arrange paneling for best match of adjacent units. Install with uniform tight joints.
F. Nail siding at each stud. Do not allow nails to penetrate more than one thickness of siding, unless otherwise recommended by siding manufacturer. Seal joints at inside and outside corners and at trim.

END OF SECTION

LP TechShield® RADIANT BARRIER

Installation Instructions

LP® TechShield® Radiant Barrier Sheathing

Basic Uses

LP® TechShield® Radiant Barrier Roof Sheathing installs just like regular roof sheathing, so there are no additional labor costs. But unlike conventional sheathing, LP TechShield sheathing features a thin, durable layer of aluminum laminated to our OSB roof sheathing. This creates a highly effective radiant barrier. Because it helps block radiant heat from entering a home, LP TechShield Radiant Barrier Sheathing can reduce monthly air conditioning bills by up to 17%. That's built-in savings that start immediately and will last for years to come.

Climate Considerations

The benefits of radiant barrier sheathing will vary by climate and will have the most impact on reducing cooling costs when used in warm climate regions that have significant solar radiation.

Condensation

Under certain conditions, moisture may condense on the underside of roof sheathing. In most circumstances, any condensation that forms will dissipate as the attic warms. During extended cold weather, however, condensation may form as frost and could accumulate. To minimize this, radiant barrier sheathing should be installed in homes with well-ventilated attics that have been properly air sealed to prevent transfer of moist heated air from the living space to the attic.

Storage and Handling

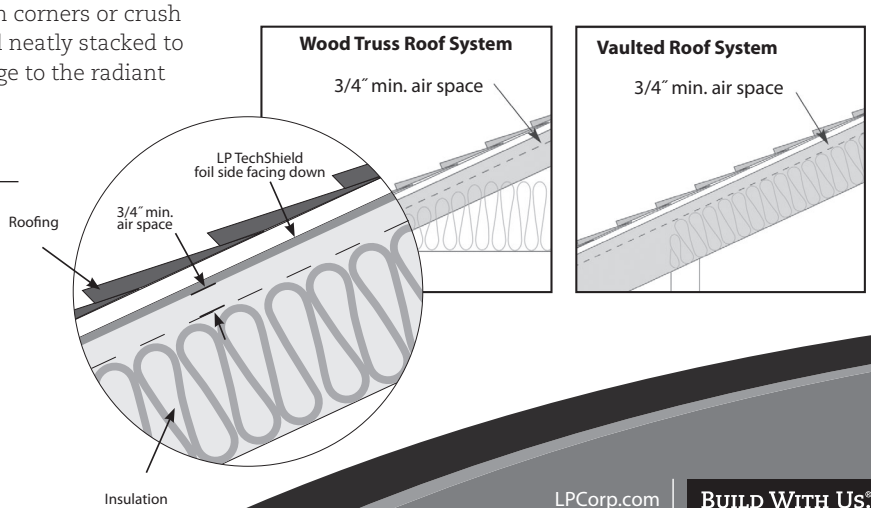
Store LP TechShield panels in a clean, dry area. Do not store in direct contact with the ground. Protect from moisture prior to and during installation. Outside storage, if necessary, requires panels to be covered with plastic sheets or tarpaulins with the sides loosely covered to provide adequate air ventilation.

Handle LP TechShield panels as you would other APA rated LP sheathing products. Be careful not to drop on corners or crush panel edges. Keep panels well supported and neatly stacked to prevent warping. Use caution to avoid damage to the radiant barrier foil surface.

Roof Sheathing Installation

- Place the skid-resistant side up with the APA trademark stamp facing down and wear skid-resistant shoes when installing the roof sheathing.
- Install with the long dimension or strength axis of the panel across supports and with the panel continuous over two or more spans.
- Provide 1/8″ minimum space at panel ends and edges. Use a spacer tool (i.e. 10d box nail) to assure accurate and consistent spacing.
- Panel end joints shall occur over framing. Stagger end joints in each succeeding row.
- Provide additional panel stiffness by installing panel edge clips mid-span on all unsupported edges.
- Nail 6″ o.c. along supported panel ends and edges and 12″ o.c. at intermediate supports. Fasten panels 3/8″ from panel edges. Use 8d common nails for panels up to 1″ thickness. For panels over 1″ use 8d ring-shank or 10d common nails. Other code-approved fasteners may be used.
- Cover roof sheathing as soon as possible with roofing felt or shingle underlayment for protection against excessive moisture prior to roofing. If any edge swelling occurs prior to roof underlayment installation, all raised joints should be sanded flat.
- Allow sheathing to adjust to humidity and moisture conditions before shingle installation.
- Remove wrinkles and flatten surface of shingle underlayment before installing shingles. High performance shingle underlayment is recommended for better results.
- Heavier weight and/or textured shingles are recommended to better mask imperfections in roofing assembly.

NOTE: Check with your local building department before deciding on an installation method.



LP TechShield® RADIANT BARRIER

Installation Instructions

LP® TechShield®
Radiant Barrier Sheathing
(cont.)

Gable Installation

Installing LP TechShield sheathing in the gable ends will help contribute to the reduction in solar gain and the overall energy-efficient design of the attic space. As with the installation of LP TechShield sheathing on roofs, it is important that it is installed with the foil side facing into the attic.

Recommended uniform roof live loads for APA-rated sheathing[c] LP TechShield with long dimension perpendicular to supports[e]

APA-RATED SHEATHING[c]		MAXIMUM SPAN (IN.)		ALLOWABLE LIVE LOADS (PSF)[d]						
Panel Span Rating	Performance Category[f]	With Edge Support[a]	Without Edge Support	Spacing of supports center-to-center (in.)						
				12″	16″	20″	24″	32″	40″	48″
24/0	3/8	24	20[b]	190	100	60	30			
24/16	7/16	24	24	190	100	65	40			
32/16	15/32, 1/2	32	28	325	180	120	70	30		
40/20	19/32, 5/8	40	32		305	205	130	60	30	
48/24	23/32, 3/4	48	36			280	175	95	45	35

(a) Panel edge clips (one midway between each support, except two equally spaced between supports 48″ on center), lumber blocking or other

(b) 24″ for 15/32″ and 1/2″ panels

(c) Includes APA-RATED SHEATHING/CEILING DECK

(d) 10 psf dead load assumed

(e) Applies to panels 24″ or wider applied over two or more spans

(f) Performance category replaces the nominal panel thickness

For a copy of the warranty or for installation and technical support visit: LPCorp.com/TechShield
Phone: 888.820.0325
Email: Customer.Support@LPCorp.com

Cal. Prop 65 Warning: Use of this product may result in exposure to wood dust, known to the State of California to cause cancer.

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LP TechShield® RADIANT BARRIER

LP® TechShield® Radiant Barrier Sheathing

Roof sheathing installation for metal roofing.

LP® TechShield® works fine with a metal roof as long as you follow the installation instructions, making sure to leave a 3/4" air space for the foil surface of the LP TechShield radiant barrier.

Figure 1
Wood Truss Roof System

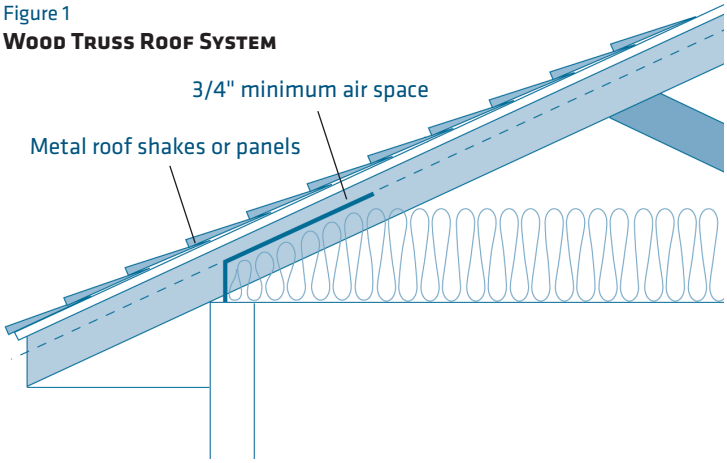
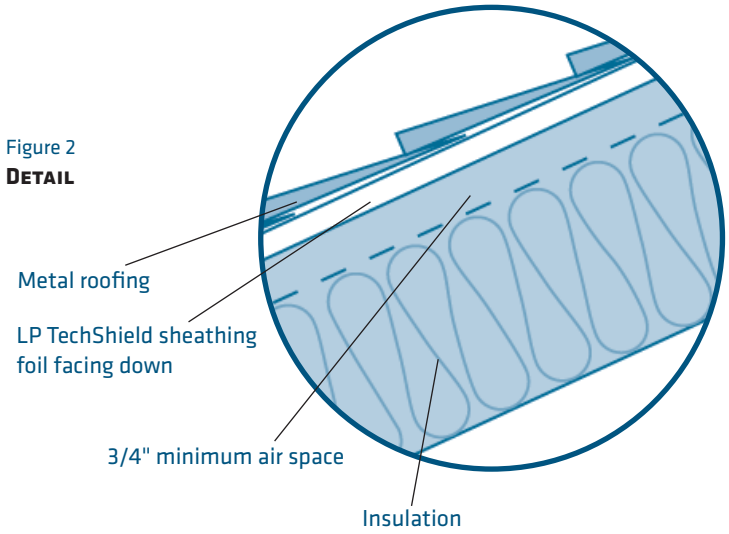


Figure 2
Detail



These steps are necessary.

1. Always check for uniform rafter alignment. Be sure to use LP TechShield with the proper thickness for the required on-center rafter spacing.
2. Provide adequate roof ventilation according to building code in your area.
3. Panel spacing on ends and edges should be 1/8".
4. Place LP TechShield radiant barrier sheathing panels with the foil side facing down on the roof (toward the attic air space). 3/4" minimum air space required. (See Figures 1 & 2)
5. Fasten the panels a minimum of 6" on center at supported panel ends and edges and 12" on center at intermediate supports. 8d nails are recommended.
6. Protect LP TechShield panels from moisture prior to and during installation.
7. Use shingle underlayment (or 30# roofing felt) to cover roof as soon as possible to protect panels from exposure to adverse weather conditions.
8. Allow sheathing to adjust to atmospheric conditions before installation of metal roofing.
9. Install all panels with APA and LP TechShield sheathing trademarks DOWN.
10. Follow the roofing manufacturer's application instructions.

For a copy of the warranty or for installation and technical support visit: www.lpcorp.com/techshield
Phone: 888.820.0325
Email: customer.support@lpcorp.com

SUSTAINABLE FORESTRY INITIATIVE Certified Sourcing www.sfiprogram.org SFI-00003

Cal. Prop 65 Warning: Use of this product may result in exposure to wood dust, known to the State of California to cause cancer.

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6/13 LPTS????

LP TechShield® RADIANT BARRIER

Warranty

LP® TechShield® Radiant Barrier

20-Year Limited Warranty

1. WARRANTY COVERAGE

This LP limited warranty applies to the retail purchaser ("Purchaser") of LP® TechShield® OSB structural sheathing panels (the "Product") and to any owner of a building in which the Product is originally installed (together, the "Owner"). Louisiana-Pacific Corporation ("LP") warrants that its Product bearing the APA® certification will:

a. At the time of manufacture, meet or exceed the manufacturing standards under U.S. Product Standard PS2 and will exhibit none of the following manufacturing defects:

(i) delamination, cupping or warping of the OSB substrate ("Substrate Delamination"). Substrate Delamination is defined as a visible separation within the panel that results in reduction of the panel's structural strength. Minor surface irregularities such as loose or folded surface flakes and minor edge swelling do not qualify as Substrate Delamination;

(ii) delamination of TechShield radiant barrier ("Foil Delamination"). Foil Delamination is defined as either a visible separation of the TechShield foil overlay from the surface of the OSB substrate or separation of the TechShield foil components that results in a material reduction of the Product's ability to reduce solar heat gain;

and

b. When installed in accordance with the APA Engineered Wood Construction Guide in effect at the date of installation and LP's applicable published Product installation instructions, will for a period of twenty (20) years from the date of installation:

(i) perform as reasonably required of a structural sheathing material in the building in which the Product was originally installed;

(ii) exhibit no Substrate Delamination or Foil Delamination; and

(iii) will reduce radiant heat transfer to the home.

If the Product is not in conformance with this limited warranty, LP's liability is limited to the repair and replacement provisions in Section 4 below.

2. EXCLUSIONS FROM WARRANTY COVERAGE

This warranty does not provide a remedy for:

a. Damage to the Product caused by:

(i) misuse or improper handling, installation or maintenance;

(ii) alterations to the structure after the original installation of the Product;

(iii) acts of God, such as lightning, wind storm, hurricane, tornado, hail, earthquake, flood or other similar severe weather or similar natural phenomena;

(iv) design, application or construction of the structure in which the Product is installed; and

(v) transport, storage or handling of the Product prior to installation;

b. Product not installed in compliance with all applicable building codes and/or not installed and maintained according to the APA Engineered Wood Construction Guide in effect at the date of installation and LP's applicable published Product installation instructions;

c. Installation workmanship;

d. Damage from termites or other wood destroying organisms;

e. Damage from wood fungal decay or rot;

f. Damage resulting from condensation or frost accumulating on the Product; or

g. Damage resulting from an Owner's failure to comply with the inspection and maintenance requirements set out under Section 6 of this warranty.

3. EXCLUSION OF IMPLIED WARRANTIES; NO OTHER EXPRESS WARRANTIES

This warranty is the only warranty applicable to this Product and excludes all other express or implied warranties, including any implied warranty of merchantability or fitness for a particular purpose, or any warranties otherwise arising from the course of dealing or usage of trade or advertising, except where such warranties arise under applicable consumer product warranty laws and cannot lawfully be disclaimed, in which event such warranties are limited to the shortest period as permitted or required under applicable law. Some states do not allow limitations on how long an implied warranty lasts, so the above limitations may not apply to you. **No other express warranty has been made or will be made on behalf of LP with respect to this Product.**

20-Year Limited Warranty

4. REMEDIES

This section provides for the sole remedy available to the Owner from LP for any Product nonconformance. If any nonconformance of this warranty or any implied warranty is confirmed, LP, at its option, will repair or replace the non-conforming Product together with any affected surface materials, including reasonable cost of labor.

5. EXCLUSION OF OTHER REMEDIES

In no event will LP be liable for any incidental, special, indirect, multiple, punitive or consequential damages resulting from any defect in the Product supplied, including, but not limited to property damage or lost profits. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

6. RESPONSIBILITY OF OWNER/PURCHASER

Compliance with each of the items set out below in Section 6(a) and 6(b) is a condition to LP's obligations under this warranty, and failure to comply with any one or more of the items shall void any rights an Owner may have against LP.

a. Installation/Maintenance

(i) Product installation must be pursuant to installation guidelines and any remedial work promptly completed.

(ii) Full compliance with the installation and maintenance instructions in the APA Engineered Wood Construction Guide in effect at the date of installation and LP's applicable published Product installation instructions.

(iii) The structure on which the Product is used must be in compliance with all applicable building codes.

(iv) The Product cannot have been used in an exterior exposure or in an interior space that creates an exterior environment. The Product may not be in direct contact with the ground or used in any application which allows for the accumulation of condensation or other free water or which subjects the Product to a repetitive wetting condition or a high moisture environment at any time during the warranty period other than normal exposure to weather during ordinary construction delays.

b. Claims

(i) Any Owner seeking remedies under this warranty must notify LP in writing within 30 days after discovering a possible nonconformity of the Product, and before beginning any permanent repair. The owner has a duty to mitigate any damages as quickly as reasonable. This written notice should include the date the Product was installed, if known, and the mill identity number noted on the grade stamp imprinted on the panel.

(ii) **It is the Owner's responsibility to establish the date of installation and all other facts required to establish its right to any relief under this warranty. The Owner should retain any records which would tend to prove when and how the Product was installed and maintained, including but not limited to: purchase invoices and receipts, contractor's billings and installation obligations, service contracts, and building permits.**

(iii) Upon reasonable notice, the Owner must allow LP's agents to enter the property and building on which the Product is installed to inspect such Product.

The warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Customer Service: 800-648-6893
Customer.Support@LPCorp.com

Cal. Prop 65 Warning: Use of this product may result in exposure to wood dust, known to the State of California to cause cancer.

NOTE: Louisiana-Pacific Corporation periodically updates and revises its product information. To verify that this version is current, call 800-648-6893. More information is available at LPCorp.com.

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LPTS0194 5/14

SECTION 07160 – BITUMINOUS DAMPPROOFING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

A. Extent of each type of dampproofing work is indicated on drawing.

B. Apply cold-applied asphalt emulsion dampproofing specified in this section at the following location:

1. On exterior wall back-up material such as concrete masonry units and gypsum sheathing behind face brick.

C. Similar work used as exposed finish is excluded by definition and, if required, is specified as waterproofing, vapor retarder, roofing, flooring, special coating or other appropriate category.

1.3 QUALITY ASSURANCE

A. General: For each type of work, obtain primary materials from single manufacturer, to greatest extent possible. Provide secondary materials only as recommended by manufacturer of primary materials.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, installation instructions, and recommendations for each dampproofing material required. Include data substantiating that materials comply with specified requirements.

1.5 JOB CONDITIONS

A. Substrate: Proceed with dampproofing work only after substrate construction and penetrating work have been completed.

B. Weather: Proceed with dampproofing work only after substrate construction and penetrating work have been completed.

PART 2 – PRODUCTS

2.1 BITUMINOUS DAMPROOFING MATERIALS

A. General: Provide bituminous dampproofing materials which comply with the following requirements, or provide other similar products which are certified in writing by manufacturer of primary dampproofing materials to be superior in performance for application indicated.

B. Cold-Applied Asphalt Emulsion Dampproofing:

1. Asphalt Emulsion: Manufacturer's standard asphalt and water emulsion coating, recommended for below-grade exterior and for above-grade interior applications to either damp (green) or dry substrates, compounded to penetrate substrate and build to moisture-resistant coating.
2. Provide semi-fibrated type semi-mastic asbestos-free emulsion; ASTM D 1227, Type II, except containing non-asbestos fibrous reinforcement and filler materials.

C. Available Manufacturers: Subject to compliance with requirements, manufactures offering asphalt emulsion products which may be incorporated in the work include, but are not limited to, the following:

1. Celotex Corporation.
2. Certainteed Corporation.
3. Genstar Roofing Products Company.
4. J. & P. Petroleum Products, Inc.
5. Karnak Chemical Corporation.
6. Koopers Company, Inc.
7. Lunday Thagard Company, Inc.
8. Manville Building Products Corp.
9. Sonneborne Bldg. Products/Rexnord Chemical Products Inc.

10. Tamko Asphalt Products, Inc.
11. Tremco Company.

D. Reinforced-Asphalt Sprayed Dampproofing:
   1. General: Manufacturer's standard 2-component product, consisting of spray-grade cold bituminous compound and glass fiber, produced and recommended specifically for dampproofing and waterproofing applications, intended for mixing at spray nozzle during installation.

E. Miscellaneous Materials:
   1. Glass Fiber Mat: Manufacturer's standard non-woven fabric of continuous filament or jack-straw filament/yarn pattern of glass, impregnated and bound together with type of organic/synthetic binder which is compatible with type of bituminous compound indicated to be reinforced, weighing 1.0to 1.5 lbs. Per 100 sp. ft., 36" wide rolls.

F. Bituminous Grout: ASTM D 147.

G. Plastic Cement: ASTM D 491, asphalt base, except provide coal-tar base where specifically recommended by manufacturer of bituminous dampproofing materials.

PART 3 – EXECUTION

3.1 PREPARATION OF SUBSTRATE

A. Clean substrate of projections and substances detrimental to work; comply with recommendations of prime materials manufacturer.

B. Install cant strips and similar accessories as shown and as recommended by prime materials manufacturer even though not shown.

C. Fill voids, seal joints, and apply bond breakers (if any) as recommended by prime materials manufacturer, with particular attention at construction joints.

D. Prime substrate as recommended by prime materials manufacturer.

E. Protection of Other Work: Do not allow liquid and mastic components to enter and clog drains and conductors. Prevent spillage and migration onto other surfaces of work, by masking or otherwise protecting adjoining work.

3.2 INSTALLATION

A. General: Comply with manufacturer's instructions, except where more stringent requirements are shown or specified, and except where project conditions require extra precautions or provisions to ensure satisfactory performances of work.

B. Cold-Applied Asphalt Emulsion Dampproofing Installation:
   1. General: Except as otherwise indicated, and whether or not indicated on drawings, apply cold-asphalt emulsion dampproofing to the following surfaces:
      a. Spray, brush, or roll apply cold-applied asphalt emulsion dampproofing to the entire exterior facing surface of CMU and concreter back-up behind masonry veneer.
      b. At all joints in sheathing back-up material and joints between sheathing and other materials (including flashings) behind masonry veneer, apply two coats of cold-applied asphalt emulsion dampproofing in 6-inch wide strips. Before first coat thickens, embed glass fiber mat reinforcement in first coat.
   2. Bituminous Cant Strips: Install 2 x 2 (or size appropriate with conditions) cant strips of bituminous grout and reinforcement art base of vertical dampproofing where it meets horizontal surface.
   3. Extend vertical dampproofing down walls from top of cavity to top of footing, extend over top of flashing and turn down minimum of 6" over face of flashing. Extend 6" onto intersecting walls and flashings but do not extend onto surfaces which will be exposed to view when project is completed.
   4. Apply coat of semi-fibrated, semi-mastic, asphalt emulsion dampproofing materials, by brushing, rolling or spraying at rate of 5.0 gal. Per 100 sq. ft., to produce uniform, dry film thickness of not less than 30 mils.

END OF SECTION

SECTION: 07265 Vapor Retarder Air Barrier

PART 1: GENERAL

1.01 SUMMARY
- A. Section include materials & Installation methods of the air barrier system
- B. Related Sections:
    1. Masonry
    2. Stucco
    3. Insulation
    4. Fire stopping
    5. Roofing
    6. Sealants
    7. Frames, Windows & Doors
    8. Exterior Gypsum Sheathing

1.02 REFERENCES
- A. ASTM D 2939: Solids by Weight and Volume
- B. ASTM D 412: Tensile Strength & Elongation
- C. ASTM D 4586 modified: Elevated Temperature Sag Resistance
- D. ASTM E 96, Method B: Water Vapor Permeance (perms)
- E. ASTM E 283 modified: Air Rate Leakage Thru Cured film
- F. FL Building Code, TAS 114: Bond Strength to Concrete, Structural Performance/Adhesion Under Static Air Pressure ("Wind Resistance")

1.03 SYSTEM DESCRIPTION
- A. Provide a continuous air barrier system where indicated

1.04 SUBMITTALS
- A. Prior to commencing the Work, submit documentation from an approved independent testing laboratory that demonstrates the air leakage rates and bond strength to concrete
- B. Prior to commencing the work submit the product literature from the air barrier manufacturer
- C. Prior to commencing the Work, submit references on a minimum of 5 projects
- D. Prior to commencing the Work, submit manufacturers' product data, samples and complete set of details for the air barrier membrane system showing a continuous plane of air tightness throughout the building envelop.

1.05 QUALITY ASSURANCE
- A. Installer: Submit in writing a document stating that the applicator of the primary air barrier system specified is an acceptable applicator to the manufacturer
- B. Perform Work in strict adherence to the manufacturer's instruction
- C. Maintain one (1) copy of manufacturer's application instructions on job site
- D. Allow access to the Work by the air barrier manufacturer's representative
- E. Components used in this section shall be obtained from a single distributor
- F. With 7 days notice a pre-job conference is to convene prior to commencing the Work
- G. Mock up: as directed by the architect and it may remain as part of the Work

1.06 DELIVERY, STORAGE and HANDLING
- A. Deliver materials to the job site in undamaged and original packaging indicating the name of the manufacturer and the product

B. Store rolls materials on end and in original packaging and always above 40°F. Keep away from all flame or excessive heat

1.07 PROJECT CONDITIONS
A. WORK is to be performed only in climatic conditions stipulated by manufacturer
B. All preparation work must be complete prior to installation of air barrier membrane

1.08 COORDINATION
A. Ensure that the air barrier membrane is continuous where indicated in the drawings

1.09 ALTERNATES
A. Submit alternates in accordance with Section 01 63 00
B. Alternate submission shall include
1. Independent laboratory testing of air barrier leakage rate, tensile strength, elongation at break, sag resistance at elevated temperatures, bond strength to concrete
C. Acceptable alternates will be confirmed by addendum. Substitute materials not approved in writing prior to bid shall not be permitted for use on this project.

PART 2: PRODUCTS

2.01 MANUFACTURERS
A. Acceptable products: one component, EPA VOC compliant liquid applied, elastomeric membranes

B. Primary Air Barrier Membrane Manufacturers
1. Wall Guardian FW-100 by STS Coatings, 210-377-1055
2. Air Blok 31 by Henry Co., 800-486-1278
3. Performance characteristics:
a. Elongation >90%, ASTM D 412
b. WVT, 10 to 13 perms, ASTM E-96 Method B
c. 180°F Sag Test, Pass, ASTM D 4586
d. 1,000 lbf, Bond Strength to Concrete, FBC (FL Bldg. Code) TAS 114, modified, Appendix H Section 2
e. Less than 0.0002 CFM/ft², Air Rate Leakage, ASTM E 283, modified

C. Transition Membrane
1. WT -250 by Wall Guardian
2. Blueskin SA by Henry Co. (Primer Required)

PART 3: EXECUTION

3.01 EXAMINATION
A. Verify that surfaces and conditions are ready to accept the Work of this section. Follow all manufacturer instructions on acceptability of substrate.

3.02 PREPARATION
A. All substrates must be sound, hand dry, clean and free of oil, grease,

excess mortar, dust or other contaminants. Note: Do not use will urethane caulking. Starting the Work is an acceptance of the substrate.

3.03 INSTALLATION

A. Transition Sheet

1. Position transition sheet and remove protective film. Press firmly into place. Ensure 2" overlap at all end and side laps.
2. Roll all laps with a steel or rubber roller while pressing firmly.
3. Make sure all preparatory work is complete before air barrier membrane application

B. Air Barrier

1. Frame Walls with OSB, plywood, gypsum sheathing including Dens Glass Gold
   a. Wall Guardian FW-100, 3.75 gallons per 100 ft² minimum
   b. Air Blok 31, 5.4 gallons per 100 ft² average
   c. Treat joints in sheathing in accordance with manufacturers literature
2. CMU Walls
   a. Wall Guardian FW-100, 3.75 gallons per 100 ft² minimum
   b. Air Blok 31, 5.4 gallons per 100 ft² average
   c. Treat deficiencies in substrate in accordance with manufacturer instructions

3.04 PROTECTION OF FINISHED WORK

A. These materials are not meant for permanent exposure:

1. Wall Guardian FW-100, 6 months maximum
2. Air Blok 31, maximum 6 weeks and less in summer

Note: Do not use with urethane caulk as the materials are incompatible.

END OF SECTION 07265

SECTION 07272 – PENETRATION SEALS

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Divisions – Specifications sections, apply to work specified in this Section.

1.2 SCOPE

A. Work includes furnishing and installing fire and smoke barrier penetration seals for openings in rated floor, wall, and other elements of construction.

1.3 RELATED WORK OF OTHER SECTIONS

A. Coordinated work of this Section with work of other Sections as required to properly execute the WORK and as necessary to maintain satisfactory progress of the work of other Sections

1.4 QUALITY ASSURANCE

A. Arrange for work to be performed by an applicator having at least two years experience installing UL classified firestopping.
   1. If requested, provide a list of past projects for verification of required experience.
B. Materials shall have been tested too provide fire rating equal to that of the construction, within the actual depth and thickness of the construction.

1.5 SUBMITTALS

A. Submit shop drawings showing each condition requiring penetration seals indicating proposed UL system materials, anchorage, methods of installation, and actual adjacent construction,
   1. Submit a copy of UL illustration of each proposed system indicating manufacture approved modifications.
B. Submit copies of manufacturer's specification, recommendations, installation instructions, and maintenance data for each type of material required. Include letter of certification or certified test laboratory report indicating that each material complies with the requirements and its recommended for the applications shown

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver material undamaged in manufacture's clearly labeled unopened containers, identified with brand, type, grade and UL label where applicable.
B. Coordinated delivery with scheduled installation data to allow minimum storage time at Site.
C. Store materials in clean, dry, ventilated location. Protect from soiling, abuse, and moisture. Follow manufacturer's instructions.

1.7 PROJECT CONDITIONS

A. Existing Conditions
   1. Verify existing conditions and substrates before starting Work. Correct unsatisfactory conditions before proceeding
   2. Proceed with installation only after penetration of the substrate and supporting brackets have been installed.
B. Environmental Requirements:
   1. Furnish adequate ventilation if using solvent
   2. Furnished forced air ventilation during installation if required by manufacturer.
   3. Keep flammable materials away from sparks or flames
   4. Provide masking and drop cloths to prevent contamination of adjacent surfaces by fire stopping materials
   5. Maintain minimum 40° F temperature of substrate for 24 hours before, during and 24 hours after application of fire stopping materials.

1.8 GUARANTEE

A. Submit copies of written guarantee agreeing to repair or replace joint sealers which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, by submitted manufacturer's data as an inherent quality of the material for the exposure indicated. The guarantee period shall be one year from date of Substantial Completion.

PART 2- PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with requirements, provide products of one of the following manufacturers as applicable o each type of penetration.
   1. Dow Corning Corp., Midland, Michigan
   2. 3M, Electrical Products Divisions, St. Paul, Minnesota
   3. Bio Fireshield, Concord, Massachusetts

2.2 MATERIALS

A. Subject to compliance with requirements, provide products of one of the following manufacturers as applicable to each type of penetration.
B. Provide asbestos free materials that comply with applicable Codes and have tested in accordance with UL 1479 or ASTME E 814

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean surfaces to be in contact with penetration seal materials of dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting, adhesion, or the required fire resistance.

3.2 INSTALLATION

A. Install penetration seal materials in accordance with printed instructions of the UL Building Materials Directory and in accordance with manufacturer's instructions.
B. Seal holes or voids made by penetration to ensure an effective smoke barrier.
C. Where floor openings are 4" or more in width and subject to traffic or loading, install firestopping materials capable of supporting same loading as floor.
D. Remove damming materials after curing if made of other than fire resistant materials.
E. Protect materials from damage on surfaces subject to traffic.

3.3 FIELD QUALITY CONTROL

A. Examine penetration sealed areas to ensure proper installation before concealing or enclosing areas
B. Keep areas of work accessible until inspection by applicable Code authorities
C. Perform under this section Patching and repairing of firestopping caused by cutting or penetration by other trades

3.4 ADJUSTING AND CLEANING

A. Clean up spills of liquid components with solvent
B. Neatly cut and trim material with sharp knife or blade as required
C. Remove materials and debris, leaving area undamaged, clean condition

END OF SECTION

SECTION 07591 - MEMBRANE REROOFING PREPARATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Roof tear-off.
2. Partial roof tear-off.
3. Roof re-cover preparation.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Temporary Roofing: Include Product Data and description of temporary roofing system. If temporary roof will remain in place, submit surface preparation requirements needed to receive permanent roof, and submit a letter from roofing membrane manufacturer stating acceptance of the temporary membrane, and that its inclusion will not adversely affect the roofing system's resistance to fire and wind.

C. Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including exterior and interior finish surfaces, that might be misconstrued as having been damaged by reroofing operations. Submit before Work begins.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Installer of new membrane roofing system.

B. **Preliminary Reroofing and** Reroofing Conference: Conduct conference at **Project site**.

1.4 PROJECT CONDITIONS

A. Provide Owner with not less than **72** hours' notice of activities that may affect other operations.
1. Before working over structurally impaired areas of deck, evacuate occupants from below the affected area. Verify that occupants below the work area have been evacuated prior to proceeding with work over the impaired deck area.

B. Protect building to be reroofed, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from reroofing operations.

C. Limit construction loads on roof to rooftop equipment wheel loads and for uniformly distributed loads.

D. Weather Limitations: Proceed with reroofing preparation only when existing and forecasted weather conditions permit Work to proceed without water entering into existing roofing system or building.

PART 2 - PRODUCTS

2.1 RECOVER BOARDS

A. Refer to Structural drawings and specifications

2.2 AUXILIARY REROOFING MATERIALS

A. General: Auxiliary reroofing preparation materials recommended by roofing system manufacturer for intended use and compatible with components of new membrane roofing system.

B. Base Sheet Fasteners: Capped head, factory-coated steel fasteners, listed in FMG's "Approval Guide."

C. Metal Flashing Sheet: Metal flashing sheet is specified in Division 7 Section "Sheet Metal Flashing and Trim."

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect existing membrane roofing system that is indicated not to be reroofed.

B. Coordinate with Owner to shut down air intake equipment in the vicinity of the Work. Cover air intake louvers before proceeding with reroofing work that could affect indoor air quality or activate smoke detectors in the ductwork.

C. Verify that rooftop utilities and service piping have been shut off before commencing Work.

3.2 ROOF TEAR-OFF

A. General: Notify Owner each day of extent of roof tear-off proposed **and obtain authorization to proceed**.

B. Remove aggregate ballast from roofing membrane.

C. Remove loose aggregate from aggregate-surfaced built-up bituminous roofing with a power broom.

D. Roof Tear-Off: Remove existing roofing membrane and other membrane roofing system components down to the deck.

1. Bitumen and felts that are firmly bonded to concrete decks are permitted to remain if felts are dry. Remove unadhered bitumen and felts and wet felts.
2. Remove excess asphalt from steel deck.
3. Remove fasteners from deck.

3.3 DECK PREPARATION

A. Inspect deck after tear-off of membrane roofing system.

1. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263 or by pouring 1 pint (0.5 L) of hot roofing asphalt on deck at start of each day's work and at start of each roof area or plane. Do not proceed with roofing work if moisture condenses under the plastic sheet or if asphalt test sample foams or can be easily and cleanly stripped after cooling.

B. If broken or loose fasteners that secure deck panels to one another or to structure are observed, or if deck appears or feels inadequately attached, immediately notify Architect. Do not proceed with installation until directed by Architect.

C. If deck surface is not suitable for receiving new roofing, or if structural integrity of deck is suspect, immediately notify Architect. Do not proceed with installation until directed by Architect.

D. Remove temporary roofing membrane before installing new roofing membrane.

3.4 ROOF RE-COVER PREPARATION

A. Remove blisters, ridges, buckles, and other substrate irregularities from existing roofing membrane that inhibit new recover boards from conforming to substrate.

1. Remove loose aggregate from aggregate-surfaced, built-up bituminous roofing with a power broom.
2. Broom clean existing substrate.
3. Coordinate with Owner's inspector to schedule times for tests and inspections before proceeding with installation of recover boards.
4. Verify that existing substrate is dry before proceeding with installation of recover boards. Spot check substrates with an electrical capacitance moisture-detection meter.
5. Remove materials that are wet or damp. Removal will be paid for by adjusting the Contract Sum according to unit prices included in the Contract Documents.
6. Provide additional uplift securement for existing roofing system with new screws and plates applied to each roof zone at the following densities:

    a. Field of roof, one fastener for each <**Insert area**>.
    b. Corners of roof, one fastener for each <**Insert area**>.
    c. Perimeters of roof, one fastener for each <**Insert area**>. Width of perimeter zone of roof is <**Insert dimension**>.

3.5 EXISTING BASE FLASHINGS

A. Remove existing base flashings around parapets, curbs, walls, and penetrations.

1. Clean substrates of contaminants such as asphalt, sheet materials, dirt, and debris.

B. Do not damage metal counterflashings that are to remain. Replace metal counterflashings damaged during removal with counterflashings [**of same metal, weight or thickness, and finish.**] [**specified in Division 7 Section "Sheet Metal Flashing and Trim."**] [**specified in Division 7 Section "Manufactured Roof Specialties."**]

C. Remove existing parapet sheathing and replace with new [**pressure-preservative**] [**exterior fire-retardant**]-treated plywood sheathing, [**19/32 inch (15 mm)**] <**Insert thickness**> thick. If parapet framing has deteriorated, immediately notify Architect.

1. Plywood parapet sheathing is specified in Division 6 Section "[**Rough Carpentry**] [**Miscellaneous Carpentry**]."

3.6 RECOVER BOARD INSTALLATION

A. Install recover boards over [**roof insulation**] [**roofing membrane**] with long joints in continuous straight lines and end joints staggered between rows. Loosely butt recover boards together[**and fasten to deck**].

1. Fasten to resist wind-uplift pressure at corners, perimeter, and field of roof specified in Division 7 Section "[**Built-up Asphalt Roofing**] <**Insert Section title**>."

3.7 DISPOSAL

A. Collect and place demolished materials in containers. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

B. Transport demolished materials off Owner's property and legally dispose of them.

END OF SECTION 07591

SECTION 07610
Metal Roofing

PART 1 - GENERAL

1.01 DESCRIPTION

A. General:
1. Furnish all labor, material, tools, equipment and services for all preformed roofing as indicated, in accord with provisions of Contract Documents.
2. Completely coordinate with work of all other trades.
3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.
4. See Division 1 for General Requirements.

B. Related work specified elsewhere:

1. Structural steel: Section 05100.
2. Steel joists: Section 05200 or 05400.
3. Flashing and sheet metal: Section 07600.

1.02 QUALITY ASSURANCE

A. Applicable Standards:

1. SMACNA: "Architectural Sheet Metal Manual", Sheet Metal and Air Conditioning Contractors National Association, Inc.
2. LGSI: “Light Gage Structural Institute”
3. AISC: "Steel Construction Manual", American Institute of Steel Construction.
4. AISI: "Cold Form Steel Design Manual", American Iron and Steel Institute (1996 Edition).
5. UL580: " Tests for Uplift Resistance of Roof Assembles", Underwriters Laboratories, Inc.
6. ASTM E 1592-95: "Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference", American Society for Testing and Materials
7. UL2218: Class 4 Impact Resistance Rating
8. Dade County (Florida) Acceptance Report Number 01-0221.02. (Craftsman SB Only)
9. ASTM E 283-84: “Standard Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Difference Across the Specimen”, American Society for Testing and Materials.

NOTICE
Contact MBCI for the proper combination of panel gauge, clip type, clip spacing and substructure to achieve a TDI Tier 2 rated system.

10. ASTM E 331-83: “Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference”, American Society for Testing and Materials. ASTM A 792-83-AZ50 (Painted) & ASTM A792-83-AZ55 (Bare Galvalume Plus®): "Specifications for Steel Sheet, Aluminum-Zinc Alloy Coated by the Hot Dip Process, General Requirements (Galvalume®)", American Society for Testing and Materials
11. ASTM E 408-71: Standard Test Method for Total Normal Emittance of Surfaces Using Inspection- Meter Techniques. (Energy Star® for Roof Products).
12. ASTM E 903-96 Standard Test Method for Solar Absorptance, Using Integrating Spheres. (Energy Star® for Roof Products)

B. Manufacturer's Qualifications:
1. Manufacturer has a minimum of five years experience in manufacturing metal roof systems of this nature. Panels specified in this section shall be produced in a factory environment (not with a portable roll former with fixed-base roll forming equipment) and in line leveling assuring the highest level of quality control. A letter from the manufacturer certifying compliance will accompany the product material submittals.

C. Installation Contractor's Qualifications:

1. Installation contractor shall be an approved installer, certified by the manufacturer before the beginning of installation of the metal roof system, specifically for MBCI's **Craftsman™** metal roof system, Certification by manufacturer must include the following:
   a. Maintain $250,000 minimum general liability insurance coverage.
   b. Maintain statutory limits of worker's compensation coverage as mandated by law.
   c. Have no viable claims pending regarding negligent acts or defective workmanship on previously performed or current projects.
   d. Has not filed for protection from creditors under any state or federal insolvency or debtor relief statutes or codes.
   e. Project foreman is the person having received certification by the manufacturer specific training in the proper installation of the selected metal roof system and will be present to supervise whenever material is being installed. Specific certified installer program shall include the following:
      1. The instructor must have a minimum of 10 years' experience in the application of metal roof systems.
      2. A formal syllabus for the classroom and hands-on training.
      3. Classroom instruction with review and thorough understanding of the specific product's technical manual.
      4. Hands-on mock-up instruction with a review and thorough understanding of the specific product's details.
      5. The installation contractor must pass a written and oral exam.
   f. Provide five references from five different architects or building owners for projects that have been in service for a minimum of two years, stating satisfactory performance by the installation contractor.
   g. Provide certification letter that installation contractor has a minimum of three years of metal product installation experience immediately preceding the date upon which work is to commence.

D. Pre-Installation Conference:

1. Prior to installation of roofing system, conduct a pre-installation conference at the project site.
2. Attendance: Owner, Architect, Contractor, Project Superintendent, and Certified Installer
3. Agenda:
   a. Roofing details and agenda
   b. Critical work sequencing and review of phasing plan
   c. Inspection sequencing

1.03 SYSTEM PERFORMANCE REQUIREMENTS

A. Performance Testing:

1. Metal roof system must be tested in accordance with **Underwriters Laboratories, Inc. (UL) Test Method 580** "Tests for Uplift Resistance of Roof Assemblies".
2. Metal roof system must be installed in accordance with UL Construction Method 282 or 309 (High Batten). See the current UL Roofing Materials and Systems Directory for requirements of each Construction Method.
3. Panel clip spacing will not exceed spacing specified in the UL Construction Method and must be designed to meet requirements of specified building codes and design loads.
4. Metal roof system must be tested in accordance with ASTM E 1592-95 for negative loading. Determine panel bending and clip-to-panel strength by testing in accordance with ASTM E 1592-95 procedures. Capacity for gauge, span or loading other than those tested may be determined by interpolating between test values only.

5. Metal roof system must be tested in accordance with ASTM E 283-84 "Standard Test Method for Air Infiltration" with a uniform static air pressure differential of 4 psf. The resulting air infiltration leakage rate will be a minimum of [(16.5" Small Batten or High Batten)-(0.035 cfm/sq ft.) or (12" Small Batten or High Batten)-(0.048 cfm/sq ft.)].
6. Metal roof system must be tested in accordance with ASTM E 331-83 "Standard Test Method for Water Penetration" with a uniform static air pressure differential of 4 psf. The resulting water penetration rate will be no uncontrollable water leakage when five gallons of water per hour is sprayed per square foot of roof area (five gallons per hour equates to 8 inches of rainfall per hour).

7. Metal Roof Panels shall be high reflectance and high emittance in accordance with Energy Star®. Initial Reflectance (Galvalume Only) shall be at least 0.68 when tested with ASTM E- 903. The three year aged reflectance shall be at least 0.57, when tested in accordance with ASTM E-1918 (Measured As Solar Reflectivity, Not Visible Reflectance).

1.04 DESIGN REQUIREMENTS

A. Roof Design Loads:

1. Design criteria shall be in accordance with the most current version of IBC or an applicable national or local building code.
2. Dead Loads
   a. The dead load shall be the weight of the SSMR system. Collateral loads, such as sprinklers, mechanical and electrical systems, and ceilings shall not be attached to the panels.
3. Live Loads
   a. The panels and concealed anchor clips shall be capable of supporting a minimum uniform live load of 20 psf.
4. Roof Snow Loads
   a. The design roof snow loads shall be as shown on the contract drawings.
5. Wind Loads
   a. The design wind uplift pressure for the roof system shall be as shown on the contract drawings. The design uplift force for each connection assembly shall be that pressure given for the area under consideration,

multiplied by the tributary load area of the connection assembly. The safety factor listed below shall be applied to the design force and compared against the ultimate capacity. Prying shall be considered when calculating fastener design loads.

aa. Single fastener in each connection: 3.00
bb. Two or more fasteners in each connection: 2.25

6. Thermal Loads
   a. Roof panels shall be free to move in response to the expansion and contraction forces resulting from a total temperature range of 90 degrees Max. degrees F during the life of the structure.

B. Framing Members Supporting the SSMR System

1. Any additions/revisions to framing members supporting the SSMR system to accommodate the manufacturer/fabricator's design shall be the Contractor's responsibility and shall be submitted for review and approval. New or revised framing members and their connections shall be designed in accordance with Refer to structural. Maximum deflection under applied live load, snow or wind load shall not exceed L/180 of the span length.

1.05 SUBMITTALS

A. Shop Drawings:

1. Submit complete shop drawings and erection details, approved by the metal roofing manufacturer, to the architect for review. Do not proceed with manufacture of roofing materials prior to review of shop drawings and field verification of all dimensions. Do not use drawings prepared by the architect for shop or erection drawings.
2. Shop drawings show methods of erection, roof and wall panel layout, sections and details, anticipated loads, flashings, sealants, interfaces with all materials not supplied and proposed identification of component parts and their finishes.

B. Performance Tests:

1. Submit certified test results by a recognized testing laboratory or manufacturer's lab (witnessed by a professional engineer) in accordance with specified test methods for each panel system.

C. Calculations:

1. Submit engineering calculations defining all cladding loads for all roof areas based on design criteria listed in Para 1.04 Design Requirements, allowable clip loads and required number of fasteners to secure the panel clips to the designated substructure.
2. Compute uplift loads on clip fasteners with full recognition of prying forces and eccentric clip loading.
3. Calculate holding strength of fasteners in accordance with submitted test data provided by the fastener manufacturer based on length of embedment and properties of materials.
4. Submit thermal calculations and details of floating clip, flashing attachments, and accessories certifying the free movement in response to the expansion/ contraction forces resulting from a total temperature differential of 110 degrees F.

D. Samples:

1. Submit samples and color chips for all proposed finishes.
   a. Submit one 8-inch long sample of panel, including clips.
   b. Submit two 3 inches x 5 inch color chip samples in color selected by the architect.

E. Warranties:

Metal roof system manufacturer shall submit a specimen copy of the warranty upon final acceptance of the project. Provide one of the following warranties.

1. **Finish:**
   a. Covering bare metal against rupture, structural failure and perforation due to normal atmospheric corrosion exposure for a period of 20 years.
   b. Covering panel finish against cracking, checking, blistering, peeling, flaking, chipping, chalking and fading for a period of twenty (20) years.
2. **Weathertightness:**
   Metal roof system manufacturer shall submit a specimen copy of manufacturer's Weathertightness Warranty, including evidence of application for warranty and manufacturer's acceptance of the applicator and warranty conditions.
   a. Single Source Warranty (High Batten Only)

B. Test Reports:

1. Submit Test Reports showing that metal panels have been tested in accordance with the Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference of ASTM E 1592-95.
2. Submit Test Reports showing that metal panels meet the air infiltration requirements of ASTM E 283-84 "Standard Test Method for Air Infiltration" with a uniform static air pressure differential of 4 psf. The resulting air infiltration leakage rate will be a minimum 16.5" Small Batten or High Batten-0.035 cfm/sq ft
3. Submit Test Reports showing that metal panels meet the water penetration requirements of ASTM E 331-83 "Standard Test Method for Water Penetration" with a uniform static air pressure differential of 4 psf. The resulting water penetration rate will be no uncontrollable water leakage when five gallons of water per hour is sprayed per square foot of roof area (five gallons per hour equates to 8 inches of rainfall per hour.)

4. Submit “Dade County Acceptance Reports” showing that metal panels meet the Dade County building code requirements & Texas TDI Windstorm Requirements.

C. Metal Roof System Fabrication Certification:

1. Submit a letter from the metal roof system manufacturer certifying the **Craftsman™** panels have been produced in a factory environment (not job site roll formed) with fixed-base roll forming equipment and in line leveling.

D. Certified Installers Qualifications:

1. Submit certificate from manufacturer certifying that installer of the metal roof system has met all of the criteria outlined in "1.02 C. Installer's qualifications" and is an authorized installer certified by the manufacturer.
2. Submit the formal syllabus for the classroom and hands-on training.
3. Submit five references from five different architects or building owners for projects that have been in service for a minimum of two years, stating satisfactory performance by the installation contractor.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery:

1. Deliver metal roof system to job site properly packaged to provide protection against transportation damage.

B. Handling:

1. Exercise extreme care in unloading, storing and erecting metal roof system to prevent bending, warping, twisting and surface damage.

C. Storage:

1. Store bundled sheets off the ground sufficiently high enough to allow air circulation beneath bundle and to prevent rising water from entering bundle. Slightly elevate one end of bundle. Prevent rain from entering bundle by covering with tarpaulin, making provision for air circulation between draped edges of tarpaulin and the ground. **Prolonged Storage of sheets in a bundle is not recommended**. If conditions do not permit immediate erection, extra care should be taken to protect sheets from staining or watermarks.

1.07 WEATHERTIGHTNESS WARRANTY

A. The Contractor shall provide to the Owner, a Standard warranty signed by the roofing manufacturer of the **Craftsman® High Batten Standing Seam Roof System** as outlined below:

B. Single Source Warranty: Single Source Warranties require a certified installer on site at all times.

1. For a period of twenty (20) years from the date of substantial completion, the roofing manufacturer WARRANTS to the Building Owner ("Owner"): to furnish roof panels, flashing and related items used to fasten the roof panels and flashing including roof jack and curb attachments to the roof structure, will not allow intrusion of water from the exterior of the roofing manufacturer's Roof System into the building envelope when exposed to ordinary weather conditions and ordinary wear and usage. The Date of substantial completion is the date that is certified by the Architect, Owner, or Owner's Representative, when the roofing manufacturer's Roofing System is completed and accepted by or on behalf of the Owner.
2. **Manufacturer's Field Service**
   a. During installation, provide for two on-site inspections of roof application by qualified technical representative of the manufacturer.
   b. Upon completion of installation, provide final inspection by a technical representative of roofing manufacturer to confirm that roofing system has been installed in accordance with manufacturer's requirements.
3. The roofing manufacturer shall have the **SOLE AND EXCLUSIVE** obligation for all warranty work commencing on the date of substantial completion and under all circumstances terminates on the [# insert appropriate number of years] year anniversary of the date certified as Substantial Completion of the roofing manufacturer's Roof System. During the period in which the roofing manufacturer has any warranty obligation, the roofing manufacturer shall take appropriate actions necessary to cause the non-performing portions of the Roof System to perform their proper functions.
4. **Roofing Manufacturer's Liability**
   The total liability of the roofing manufacturer under
   Single Source III, a no dollar limit of the manufacturers Roof System as invoiced to the roofing manufacturer’s customer.

PART 2 - PRODUCTS

2.01 MATERIALS

Metal roof system profile: **A. Metal roof system profile:**

A.

1. 2 inch high x 3/8-inch wide battens (High Batten-HB) x 16½ inch] wide panels.

B. Metal roof system style:

1. Snap on batten with factory applied mastic. High Batten
2. Concealed fastener.

C. Gauge:

1. (22 gauge) (UL-90 rated-Underwriters Laboratories)

D. Substrate:

1. Galvalume sheet steel, 0.5-ounces/square foot, minimum yield 50,000 PSI.

E. Clip:

1. One piece clip with factory applied mastic, 2 inches high by 1 inch wide by 2 inches long with a guide hole in the bottom to accommodate a clip fastener (High Batten).

F. Texture:

1. Smooth

G. Finish:

1. Premium fluorocarbon coating produced with Kynar 500 or Hylar 5000 resin (20 year warranty).

H. Color:

1. Selected from metal roof system manufacturers standard offering.

I. Acceptable manufacturer:

1. MBCI - Houston, TX - (281) 445-8555.

J. Other manufacturers desiring approval, comply with Section 01630.

K. Acceptable Curb and Equipment Support units:

1. LM Curbs - Longview, TX.

L. Prefabricated Roof Jacks:

1. SFS- INTECH - Wyomissing, PA.
2. ITW Buildex - Itasca, IL.

M. Rooftop Walkways:

1. LM Curbs - Longview, TX.

2.02 MISCELLANEOUS MATERIALS

A. Fasteners:

1. All self-tapping/self-drilling fasteners, bolts, nuts, self-locking rivets and other suitable fasteners shall be designed to withstand specified design loads.
2. Use long life fasteners for all interior and exterior metal roof system applications.
3. Provide fasteners with a factory applied coating in a color to match metal roof system application.
4. Provide neoprene washers under heads of exposed fasteners.
5. Locate and space all exposed fasteners in a true vertical and horizontal alignment. Use proper torque settings to obtain controlled uniform compression for a positive seal without rupturing the neoprene washer.

B. Accessories:

1. Provide all components required per the metal roof system manufacturer's approved shop drawings for a complete metal roof system to include panels, panel clips, trim/flashing, fascias, ridge, closures, sealants, fillers and any other required items.
   a. All outside closures will be fabricated from Galvalume Plus® or Painted Galvalume® sheet steel of the same gauge, finish and color as the panels.
   b. All tape seal is to be a pressure sensitive, 100 percent solids, and polyisobutylene compound sealing tape with a release paper backing. Provide permanently elastic, non-sagging, non-toxic, non-staining tape seal approved by the metal roof system manufacturer.
   c. All joint sealant is to be a one-part elastomeric polyurethane sealant approved by the metal roof system manufacturer.

2.03 FABRICATION

A. Material shall be in-line leveled prior to roll forming the panel profile.
B. Where possible, roll form panels in continuous lengths, full length of detailed runs.
C. Standard panel length shall be no more than 40 feet long for 22 gauge and 24 gauge. (For longer length availability, contact manufacturer).
D. Fabricate trim/flashing and accessories to detailed profiles.
E. Fabricate trim/flashing from same material as panel.

2.04 PREFABRICATED CURBS AND EQUIPMENT SUPPORTS

A. Comply with loading and strength requirements as indicated where units support work of other trades. Coordinate dimensions of curbs and supports with equipment supplier/manufacturer.

B. Fabricate curbs of structural quality aluminum (Min. .080 in. thickness for mechanical gear up to 1000 lbs; .125 in. thickness for mechanical gear between 1000 lbs. and 2000 lbs.; use a two curb system per the manufacturer above 2000 lbs.), factory primed and prepared for painting with mitered and welded corner joints. Provide integral cap cells and water diverter crickets. The upper flange of the curb must be a minimum of 18" above the water diverter. (This allows 12" of free area after the panel is lapped over the flange on the high side.) Curbs shall be designed to install under metal roof system on the high side and over metal roof system on the low side.

C. Minimum height of prefabricated curb will be 8 inches above the finished metal roof system.

D. Curbs shall be constructed to match the slope of the roof and provide a level top surface for mounting equipment.

E. Curb flanges must be constructed to match the configuration of the metal roof panels and extend to a panel rib on each side. Minimum distance between curb wall and panel rib is 6".

F. Curb manufacturer will provide their own curb structural support system that can be installed between the purlins that will allow proper thermal movement of the curb with the roofing system.

G. Submit roof curb manufacturer's shop drawings to metal roof system manufacturer for review **prior to** fabrication (refer to metal roof system manufacturer's standard installation details). Metal roof system manufacturer will review roof curb manufacturer's shop drawings for compatibility with metal roof system.

2.05 PREFABRICATED ROOF JACKS

A. Pipe flashings shall be a one piece [# choose one: EPDM (ethylene propylene diene monomer) molded rubber boot having a serviceable temperature range of -65°F to 212°F (for standard applications) or silicone molded rubber boot having a serviceable temperature range of -100°F to 437°F (for high temperature applications)] and shall be resistant to ozone and ultraviolet rays. Units shall have an aluminum flanged base ring. **Do not install pipe flashings through any panel seams - install ONLY in the flat portion of the panel.**

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Examination:

1. Inspect installed work of other trades and verify that such work is complete to a point where this work may continue.
2. Verify that installation may be made in accordance with approved shop drawings and manufacturer's instructions. This specifically includes verifying that secondary structural members and/or decking are installed to meet UL and building code requirements. Coordinate with metal roof system manufacturer to insure that reduced clip spacings at eave, rake, ridge and corner areas are accommodated.

B. Discrepancies:

1. In event of discrepancy, notify the architect .
2. Do not proceed with installation until discrepancies have been resolved.

3.02 INSTALLATION

A. Install metal roof system so that it is weathertight, without waves, warps, buckles, fastening stresses or distortion, allowing for expansion and contraction.

B. Install metal roof system in accordance with manufacturer's instructions and shop drawings.

C. Provide concealed anchors at all panel attachment locations.

D. Install panels plumb, level and straight with seams and ribs parallel, conforming to design as indicated.

3.03 ROOF CURB INSTALLATION

A. Comply with metal roof system manufacturer's shop drawings, instructions and recommendations for installation of roof curbs. Refer to metal roof system manufacturer's standard installation details. Anchor curbs securely in place with provisions for thermal and structural movement.

3.04 CLEANING, PROTECTION

A. Dispose of excess materials and remove debris from site.

B. Clean work in accordance with manufacturer's recommendations.

C. Protect work against damage until final acceptance. Replace or repair to the satisfaction of the architect , any work that becomes damaged prior to final acceptance.

D. Touch up minor scratches and abrasions with touch up paint supplied by the metal roof system manufacturer.

E. **Do not allow panels or trim to come in contact with dissimilar metals such as copper, lead or graphite. Water run-off from these materials is also prohibited. This specifically includes condensate from roof top units. A/C units.**

END OF SECTION

SECTION 07620 - SHEET METAL FLASHING AND TRIM

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 sheet metal flashing and trim:
   1. Formed roof drainage system.
   2. Formed low-slope roof flashing and trim.
   3. Formed wall flashing and trim.
   4. Formed equipment support flashing.

B. Related Sections include the following:
   1. Division 4 Section "Unit Masonry Assemblies" for installing through-wall flashing, reglets, and other sheet metal flashing and trim.
   2. Division 6 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
   3. Division 7 Section "Membrane Roofing" for installing sheet metal flashing and trim integral with roofing membrane.
   4. Division 7 Section "Manufactured Roof Specialties" for manufactured roof specialties not part of sheet metal flashing and trim.
   5. Division 7 Section "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
   6. Division 7 Section "Joint Sealants" for field-applied sheet metal flashing and trim sealants.

1.3 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

C. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:
   1. Identify material, thickness, weight, and finish for each item and location in Project.
   2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
   3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
   4. Details of expansion-joint covers, including showing direction of expansion and contraction.

C. Samples for Initial Selection: For each type of sheet metal flashing and trim indicated with factory-applied color finishes.
   1. Include similar Samples of trim and accessories involving color selection.

1.5 QUALITY ASSURANCE

A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

B. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."
   1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.
   2. Review methods and procedures related to sheet metal flashing and trim.
   3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
   4. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with suitable weather-tight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.7 COORDINATION

A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leak-proof, secure, and non-corrosive installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
   2. Products: Subject to compliance with requirements, provide one of the products specified.
   3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
   4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SHEET METALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.

B. Pre-painted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by the hot-dip process and pre-painted by the coil-coating process to comply with ASTM A 755/A 755M.
   1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.
   2. Exposed Finishes: Apply the following coil coating:
      a. Factory Prime Coating: Where painting after installation is indicated, provide pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat; with a minimum dry film thickness of 0.2 mil.
      b. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
         1) Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements of AAMA 2604, except as modified below:

a) Humidity Resistance: 1000 hours.
b) Salt-Spray Resistance: 1000 hours.

2) Color: As selected by Architect from manufacturer's full range.

C. Lead Sheet: ASTM B 749, Type L51121, copper-bearing lead sheet.

2.3 UNDERLAYMENT MATERIALS

A. Polyethylene Sheet: 6-mil- thick polyethylene sheet complying with ASTM D 4397.

B. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, non-perforated.

C. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft..

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
1. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

C. Solder for Lead: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.

D. Solder for Zinc: ASTM B 32, 60 percent lead and 40 percent tin with low antimony, as recommended by manufacturer.

E. Burning Rod for Lead: Same composition as lead sheet.

F. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

G. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type non-corrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and

other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.

B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
   1. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

D. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, non-corrosive metal.
   1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

2.6 ROOF DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters: Fabricate to cross section indicated, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch- long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters.
   1. Gutter Style: “A” or as shown on plans.
   2. Expansion Joints: Lap type.
   3. Fabricate from the following material:
      a. Pre-painted, Metallic-Coated Steel: 24 gauge.

B. Downspouts: Fabricate rectangular downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.
   1. Fabricate downspouts from the following material:
      a. Pre-painted, Metallic-Coated Steel: 24 gauge.

C. Parapet Scuppers: Fabricate scuppers of dimensions required with closure flange trim to exterior, 4-inch- wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof.
   1. Fabricate parapet scuppers from the following material:
      a. Stainless Steel: 24 gauge.

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof Edge Flashing (Gravel Stop) and Fascia Caps: Fabricate in minimum 96-inch- long, but not exceeding 10-foot- long, sections. Furnish with 6-inch- wide joint cover plates.
   1. Joint Style: Butt, with 6-inch- wide exposed cover plates.
   2. Fabricate scuppers from the following material:
      a. Pre-painted, Metallic-Coated Steel: 24 gauge.

B. Copings: Fabricate in minimum 96-inch- long, but not exceeding 10-foot- long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight.
   1. Joint Style: Butt, with 6-inch- wide exposed cover plates.
   2. Fabricate copings from the following material:
      a. Pre-painted, Metallic-Coated Steel: 24 gauge.

C. Roof to Roof and Roof to Wall Transition Expansion-Joint Cover: Fabricate from the following material:
   1. Galvanized Steel: 24 gauge.

D. Counterflashing: Fabricate from the following material:
   1. Galvanized Steel: 24 gauge.

E. Flashing Receivers: Fabricate from the following material:
   1. Galvanized Steel: 24 gauge.

F. Roof-Penetration Flashing: Fabricate from the following material:
   1. Galvanized Steel: 24 gauge..

G. Roof-Drain Flashing: Fabricate from the following material:
   1. Lead: 4.0 lb/sq. ft., hard tempered.

2.8 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following material:
   1. Galvanized Steel: 24 gauge.

2.9 FINISHES

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

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are

acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.
   1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
   2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
   1. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.
   1. Coat underside of sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
   2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.
   3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.

C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.

E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
   1. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
   1. Galvanized or Pre-painted, Metallic-Coated Steel: Use stainless-steel fasteners.
   2. Stainless Steel: Use stainless-steel fasteners.

H. Seal joints with elastomeric sealant as required for watertight construction.
   1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
   2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

I. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches except where pre-tinned surface would show in finished Work.
   1. Do not solder pre-painted, metallic-coated steel sheet.
   2. Stainless-Steel Soldering: Pre-tin edges of uncoated sheets to be soldered using solder recommended for stainless steel and phosphoric acid flux. Promptly wash off acid flux residue from metal after soldering.
   3. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.

3.3 ROOF DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

B. Hanging Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with elastomeric sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored gutter brackets and straps spaced not more than 36 inches apart. Provide end closures and seal watertight with sealant. Slope to downspouts.
   1. Fasten gutter spacers to front and back of gutter.
   2. Loosely lock straps to front gutter bead and anchor to roof deck.
   3. Anchor and loosely lock back edge of gutter to continuous cleat.
   4. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24 inches apart.
   5. Install gutter with expansion joints at locations indicated but not exceeding 50 feet apart. Install expansion joint caps.

C. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.
   1. Provide elbows at base of downspout to direct water away from building.
   2. Connect downspouts to underground drainage system indicated.

D. Parapet Scuppers: Install scuppers where indicated through parapet. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
   1. Anchor scupper closure trim flange to exterior wall and seal or solder to scupper.
   2. Loosely lock front edge of scupper with conductor head.
   3. Seal or solder exterior wall scupper flanges into back of conductor head.

E. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints a minimum of 4 inches in direction of water flow.

3.4 ROOF FLASHING INSTALLATION

A. General: Install sheet metal roof flashing and trim to comply with performance requirements and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.
   1. Interlock bottom edge of roof edge flashing with continuous cleats anchored to substrate at 16-inch centers.

C. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.
   1. Interlock exterior bottom edge of coping with continuous cleats anchored to substrate at 16-inch centers.
   2. Anchor interior leg of coping with screw fasteners and washers at 18-inch centers.

D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with elastomeric sealant.
   1. Secure in a waterproof manner by means of interlocking folded seam or blind rivets and sealant.

F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:
   1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
   2. Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

3.5 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Through-Wall Flashing: Installation of formed through-wall flashing is specified in Division 4 Section "Unit Masonry Assemblies."

3.6 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.7 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07620

SECTION 07901 – WATERPROOFING, CAULKING & DAMPROOFING

PART 1 – GENERAL

1.1 WORK INCLUDED

A. Furnish all labor and materials for the completion of the waterproofing, caulking, under slab damproofing and cavity base flashing work indicated and/or specified.
   1. Rubber Base Caulking – required for all exterior work, including window, wall and door caulking. Caulk the base of all check stands with clear silicone caulking compound for interior use.
   2. Elastic caulking Compound – Regular Oil Base. Elastic caulking compound for interior use.
   3. Underslab Damproofing – All areas of new concrete slab in grade shall receive 6-mil polyethylene damproofing.
   4. Cavity base flashing – One layer of sheet vinyl
   5. Wall Damproofing – One layer of 4" wide sheet vinyl applied over horizontal and vertical joints of gypsum board sheathing.

1.2 Provide a two year written guarantee against water leakage into building's areas through work of this section. Contractor shall, within such period, take such remedial measures as may be necessary to correct conditions of leakage and repair all construction damaged or stained by such leakage.

PART 2 – PRODUCTS

2.1 CAULKING

A. All joints shall be properly prepared, clean, dry, and backed with a closed cell, compressible, non-staining, non-rotting joint backing such as polystyrene, polyurethane, neoprene, sponge, butyl sponge, etc.
B. Type "A" shall be used at all exterior and interior expansion and control joints in masonry and aluminum or steel masonry – Federal Specification TT-S-230.
   Dap- "Acrylic Polymeric Sealant"
   Dow – "790 Sealant"
   General Electric – "Silicone 1200"
   NP1 – Polyurethane
   Pecora – "60+Unicyrlic"
   Tremco – "Momo"
C. Type "B" shall be used at all other areas requiring caulking – Federal Specification TT-C-598.
   Dap – "Architectural Guide"
   Pecora – "200 R2"

2.2 UNDERSLAB DAMPROOFING

A. After sub-grade is prepared for slabs on grade; entire surface shall be covered with 6-mil polyethylene film. Any holes torn in the polyethylene film shall be carefully patched prior to pouring slab.

2.3 WALL BASE FLASHING

A. Thickness: 20 mil, sheet vinyl water barrier.
B. Manufacturer: B.F. Goodrich Company, or approved equal.
C. Flashing Adhesive: Philip Caey "Duk-Bak" No. 107, flashing adhesive, stiff-fibered mastic
D. Surfaces to be clean, dry and smooth point all holes and voids. Allow to dry.
E. Apply continuous coat of adhesive and embed vinyl, membrane horizontally to the inner wall or surfaces.
F. Lap all joints a minimum of 4" and bond membrane with adhesive. Apply one (1) additional coat of "Duk-Bak" Semi-Mastic over top of flashing.
G. Extend membrane up outside face to the inner wythe of wall a minimum of 8".
H. Keep all exposed work free of mastic.

2.4 WALL DAMPROOFING

A. Same Section 2.3 above

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install waterproofing, caulking and damproof in accordance with manufacturer instructions.

END OF SECTION

SECTION 07920 – SEALANTS

PART 1 - GENERAL

1.01 GENERAL CONDITIONS

As specified in Section 00700.

1.02 DESCRIPTION OF WORK

Completely close with sealant all joints around frames of doors, windows, or other openings in exterior walls; joints where concrete, masonry, or siding abuts other surface finishes; and all other joints indicated or specified to be sealed.

1.03 SUBMITTALS

A. Manufacturer's Data: Submit copies of manufacturer's product data and specifications for type of sealant required, to the Engineer for approval.
B. Color Samples: Three (3) sets each of color finish samples of sealants.

1.04 JOB CONDITIONS

A. Examine joint surfaces and backing, and their anchorage to the structure, and conditions under which joint sealer work is to be performed, and notify contractor in writing of conditions detrimental to proper completion of the work and performance of sealers. Do not proceed with joint sealer work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.
B. Weather Conditions: Do not proceed with installation of sealants under adverse weather conditions. Proceed with the work only when weather conditions are favorable for proper cure and development of high early bond strength.

1.05 PRODUCT HANDLING

Delivery: Deliver sealants to the jobsite in sealed containers labeled to show the designated name, formula, or specification number, lot number, color, date of manufacture, shelf life, curing time, manufacturer's directions, and name of manufacturer.

PART 2 - PRODUCTS

1.01 MATERIALS

D. Sealant Backer Rod: Compressible rod stock of polyethylene foam, polyethylene-jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable, nonabsorptive material as recommended for compatibility with sealant by the sealant manufacturer to control the joint depth for sealant placement, to break bond of sealant at bottom of joint, to form optimum shape of sealant bead on back side, and to provide a highly compressible backer which will minimize the possibility of sealant extrusion when joint is compressed.

E. Bond-Preventive Materials: One of the following as best suited for the application.
   1. Polyethylene tape, pressure-sensitive adhesive. The adhesive is required only to hold tape to the construction materials.
   2. Aluminum foil, wax paper, masking tape, and other materials as recommended by the sealant manufacturer.

C. Primer for Sealants: Nonstaining, as recommended by the sealant manufacturer.
D. Sealants:

1. All exterior joints between siding metal, concrete, and masonry surfaces: One-part polyurethane-based sealant, conforming to ASTM C 920, Type S, Grade NS, Class 25. Provide one of the following or an approved equal.
   a. Bostik Chem-Calk 900; Bostik Construction Products Div.
   b. Sikaflex-la; Sika Corp.
   c. Permapol RC-1; PRC.
   d. Dymeric; Tremco, Inc.

2. At Interior Joints: Non-Elastomeric Sealant; acrylicemulsion type, conforming to ASTM C 834. Provide one of the following, or approved equal:
   a. Acrylic Latex Caulk; Tremco.
   b. Chem-Calk 600; bostik Construction Products Div.

3. At Horizontal Joints: Two-part polyurethane-based sealant, conforming to ASTM C 920, Type M, Grade P, Class 25. Provide on of the following, or an approved equal:
   a. Rubber Calk 280; PRC.
   b. THC-900; Tremco.
   c. Sikaflex 2c SL; Sika Corp.

4. At Juncture of Toilet Fixtures: One part mildew-resistant silicone sealant, conforming to ASTM C 920, Type S, Grade NS, Class 25, use NT. Provide one of the following or approved equal:
   a. Dow Corning 786; Dow Corning Corp.
   b. SCS 1702 Sanitary; General Electric.
   c. Proglaze, White; Tremco.

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

Comply with manufacturer's printed instructions except where more stringent requirements are shown or specified, and except where manufacturer's technical representative directs otherwise.

3.02 JOINT PREPARATION

A. Clean joint surfaces immediately before installation of sealant. Remove dirt, insecure coatings, moisture and other substances which could interfere with bond of sealant. Etch concrete and masonry joint surfaces as recommended by sealant manufacturer. Roughen vitreous and glazed joint surfaces as recommended by sealant manufacturer.
B. Prime or seal joint surfaces where indicated, and where recommended by sealant manufacturer. Do not allow primer/sealer to spill or migrate onto adjoining surfaces.

3.03 INSTALLATION

A. Set joint filler units at proper depth or position in joint to coordinate with other work, including installation of bond breakers, backer rods and sealants. Do not leave voids or gaps between ends of joint filler units.
B. Install sealant backer rod for liquid Elastomeric sealants, except where shown to be omitted or recommended to be omitted by sealant manufacturer for application shown.

C. Install bond breaker tape where indicated and where required by manufacturer's recommendations to ensure that Elastomeric sealants will perform properly.
D. Employ only proven installation techniques, which will ensure that sealants are deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces equally on opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and vertical

surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.

E. Install sealant to depths as shown or, if not shown, as recommended by sealant manufacturer but within the following general limitations, measured at center (thin) section of bead:

   1. For sidewalks, pavements and similar joints sealed with Elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75% of joint width, but neither more than 5/8" deep nor less than 3/8" deep.
   2. For normal moving joints sealed with non-Elastomeric sealed with Elastomeric sealants but not subject to traffic, fill joints to a depth equal to 50% of joint width, but neither more than 1/2" deep nor less than 1/4" deep.
   3. For joints sealed with non-Elastomeric sealants fill joints to a depth in range of 75% to 125% of joint width.

F. Spillage: Do not allow sealants or compounds to overflow or spill onto adjoining surfaces, or to migrate into voids of adjoining surfaces. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage.

G. Recess exposed joint fillers slightly behind adjoining surfaces, unless otherwise shown, so that compressed units will not protrude from joints.

H. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contract and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents which discolor sealants or adjacent surfaces or are not approved by sealant manufacturer. Provide concave joint configuration per Figure 5A in ASTM C 962, unless otherwise indicated.

3.04 CURE AND PROTECTION

Cure sealants in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability. Advise Contractor of procedures required for cure and protection of joint sealers during construction period, so that they will be without deterioration or damage (other than normal wear and weathering) at time of Owner's acceptance.

END OF SECTION

Section 07 95 13 Interior Seismic Expansion Control System

PART 1 - GENERAL

1.01 Work Included

A. The work shall consist of furnishing and installing expansion joints in accordance with the details shown on the plans and the requirements of the specifications. The joints are proprietary designs utilizing extruded elastomeric seals and aluminum profiles.

B. Related Work

- Miscellaneous and ornamental metals
- Sealants and caulking
- Interior Finishes

1.02 Submittals

A. Template Drawings - Submit typical expansion joint cross-section(s) indicating pertinent dimensioning, general construction, component connections, and anchorage methods.

1.03 Product Delivery, Storage and Handling

A. Deliver products in each manufacturer's original, intact, labeled containers and store under cover in a dry location until installed. Store off the ground, protect from weather and construction activities.

1.04 Acceptable Manufacturer

A. Nystrom Building Products, 9300 73rd Ave N, Brooklyn Park, MN 55428, USA **Nystrom Building Products** Model “EJ-LCWF, EJ-LCW” Wall, Soffit and Ceiling

B. Alternate manufacturers and their products will be considered, provided they meet the design concept and are produced of materials that are equal to or superior to those called for in the base product specification.

C. Any proposed alternate systems must be submitted and receive approval 21 days prior to the bid. All post bid submittals will not be considered. This submission shall be in accordance with MATERIALS AND SUBSTITUTIONS.

- Any manufacturer wishing to submit for prior approval must provide the following:

1. A working 6” sample of the proposed system with a letter describing how system is considered superior to the specified system.

2. A project proposal drawing that illustrates the recommended alternate system installed in the wall or ceiling construction that is specific to the project. Typical catalog cut sections will not be considered.

3. Verifiable list of prior installations showing prior and successful experience with the proposed systems.

4. Any substitution products not adhering to all specification requirements within, will not be considered.

1.05 Quality Assurance

A. Warranty: The expansion control system's performance shall be warranted for a period of 1 year. Installation shall be in strict accordance with manufacturer's technical specifications, details, installation instructions and general procedures in effect for normal intended usage and suitable applications under specified design movements and loading conditions.

B. Manufacturer: Shall have a minimum ten (10) years experience specializing in the design and manufacture of Architectural Expansion Control Systems.

C. Products : Expansion Control Systems must be installed with manufacturer's blockout repair and infill material(s).

D. Maintenance: The manufacturer shall provide the owner-operator a preventive maintenance guideline for Expansion Control Systems.

PART 2 - PRODUCT

2.01 General

A. Provide interior wall and ceiling expansion joint system that incorporates specially engineered elastomeric colorable profiles to facilitate multi-directional seismic movement without stress to adjacent components. Design system to be easily installed and surface mounted to traditional drywall construction utilizing drywall screws. Aluminum extrusions shall be designed with mounting flanges exhibiting factory pre-punched holes properly sized and spaced to receive joint compound.

For walls, soffits and ceilings furnish Nystrom Building Products, Model "EJ-LCWF, EJ-LCW" Expansion Control System as indicated on drawings.

2.02 Components and Materials

A. Aluminum Extrusions - Material to conform to properties of ASTM B221, alloy 6063-T5. Profile shall be lightweight and capable of accommodating various wall and ceiling conditions. Design profile with semi-closed extrusion cavity and features that will provide a mechanical lock for the Elastomeric Seal.

B. Aluminum Shapes - Material to conform to ASTM B209, alloy 6061-T6 or 5005-H34.

C. Elastomeric Seals - Material shall be a flexible extruded Santoprene or manufacturer's alternate material exhibiting a shore A hardness of 64 +/-5 with U.V. stabilizer. The seal shall be a multi-cellular profile with side lugs that mechanically snap lock into a corresponding extrusion cavity without assistance from fasteners for a secure fit.

D. Anchors - Secure aluminum extrusion(s) by utilizing standard drywall screws for gypsum wall board construction. Screws are supplied by others and shall be of proper length to secure aluminum extrusion. Locate screws within solid metal between factory pre-punched flange holes. Anchor spacing shall be 24" o.c. maximum.

E. Accessories - Provide necessary and related parts required for complete installation.

2.03 Fabrication

A. Aluminum extrusions shall be supplied in 10 ft. lengths. The contractor shall be responsible for field cutting the extrusion to obtain the proper joint profile. All cutting and mitering of the seal required at directional changes shall be performed by the contractor in a neat and workmanlike manner utilizing manufacturers recommended splice clips and adhesive.

B. All anchor holes shall be field drilled in accordance with manufacturer's drawings. Spacing shall be a maximum of 24" o.c.

2.04 Finishes

A. Aluminum extrusions shall be supplied in standard mill finish.

B. Elastomeric seals shall be supplied in standard colors - Black, beige and gray.

PART 3 - EXECUTION

3.01 Installation

A. Protect all expansion joint component parts from damage during installation and thereafter until completion of structure.

B. Expansion joint systems shall be installed in strict accordance with the manufacturer's typical details and instructions along with the advice of their qualified representative.

C. Contractor shall provide proper and adequate adjacent construction to receive and support the expansion control joint system. The supporting framework (studding) shall be of design to secure all threaded hardware and provide rigidity for the proper installation and function of the joint system.

3.02 Clean and Protect

A. Protect system and its components during construction. After work is complete in adjacent areas clean exposed surfaces with a suitable cleaner that will not harm or attack the elastomeric material.

END OF SECTION

SECTION 8100 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1:01 The work under this section shall include the furnishing of all items shown on the drawings and as specified, including, but not limited to, the following:

A. Steel Doors
B. Steel Door Frames
C. Security Viewers

1:02 Related Sections

A. Section 04000: Masonry mortar
B. Section 06200: Finish carpentry
C. Section 07900: Caulking and sealing
D. Section 08200: Wood Doors and Frames
E. Section 08700: Finish Hardware
F. Section 08800: Glass and Glazing
G. Section 09900: Painting of steel doors and frames.

1:03 References

A. Steel Doors and Frames in this section must meet all standards as established by the following listing agencies:
1. Door and Hardware Preparation ANSI 115.1.
2. Life Safety Codes NFPA-101
3. Fire Doors and Windows NFPA-80
4. Steel Door Institute ANSI/SDI-100
5. A. D. A. of 1991
6. Texas Department of Insurance – Windstorm Requirements for exterior doors & windows

1:04 Submittals

A. Coordinate approved shop drawings with all other trades and manufacturers whose products are used in conjunction with the Steel Doors and Frames as listed under section 08100.
B. Finish hardware supplier will furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to cut, reinforce or otherwise prepare the doors and frames to receive the finish hardware items, as required.
C. The steel door and frame supplier shall furnish to the architect (6) complete copies of the proposed steel door and frames schedule and/or shop drawings. Using the same reference number for details and openings as those on the contract drawings. After receipt of the approved door schedule the steel door and frame supplier shall make any corrections to the door schedule and submit to the architect (7) sets of corrected schedules, for file and field use, if required.
D. **Approved System Test from TDI, Miami Dade or TDI approved testing laboratory for exterior windows and doors.**

1:05 Quality Assurance

A. Provide Steel Doors and Frames manufactured by a single firm specializing in the production of this type of work.
B. Provide Steel Doors and Frames complying with the Steel Door Institute recommended specifications for Standard Steel Doors and Frames ANSI/SDI 100 (Latest edition), and

as herein specified.

1:06 Delivery, Storage and Handling

A. All steel doors and frames must be properly marked with door opening mark number to correspond with the door schedule.

B. Deliver all steel doors in cartons and palletized to provide protection during transit and job storage.

C. Inspect doors and frames upon delivery for damage. Minor damage is to be repaired, provided the finish items are equal in all respects to new work and acceptable to the architect.

D. Store doors and frames at the building site under cover. Place units on wood sills or on the floor in a manner that will prevent rust and damage. Avoid the use of non-vented plastic or canvas shelters which could create a humidity chamber. If the wrapper on the door becomes wet, remove the carton immediately. Provide a 1/4 inch space between stacked doors to promote air circulation.

1:07 Job Conditions

A. Installer must examine the conditions under which steel doors and frames will be installed and notify the contractor in writing of any condition detrimental to the proper and timely completion of the work.

PART 2 PRODUCTS

2:01 Acceptable Manufacturers - As long as they meet the following specifications

A. Ceco Door Products

B. Dean Steel Manufacturing Company

C. Other SDI or NAAMM members that conform to the specific requirements of this specification.

2:02 Hardware Locations and General Reinforcements

A. Locate hardware on doors and frames in accordance with the manufactures standard locations.

B. When steel frames are used with wood doors the hardware preparation on the doors is governed by its location on the frames. If the doors are to be factory mortised, the door supplier is responsible for coordinating hardware locations.

C. Hardware reinforcements are to be in accordance with the minimum standard gages as listed in SDI-100.

D. Doors shall be mortised, reinforced and function holes provided at the factory in accordance with the hardware schedule and templates provided by the hardware supplier. Through bolt holes, attachment holes, or drilling and tapping for surface hardware, shall be done by others.

E. **Provide minimum design wind pressure for all the exterior doors & windows shall be:**
+33 psf toward the surface
-44 psf away from the surface

2:03 STEEL DOORS

A. Material

1. Face Sheets are to be made of commercial quality 16 gage zinc coated steel that complies with ASTM A525 A60. Use 14 gage at Door 27 and 38.

2. Reinforce tops and bottoms of all doors with a continuous steel channel not less than

16 gage, extending the full width of the door and welded to the face sheet.

2:06 STEEL FRAMES

A. Materials

1. Exterior frames shall be 16 gage zinc coated steel that complies with ASTM designations A526 A60. Interior frames will be 16ga cold rolled steel. Use 14 gage frame at Door 27 and 38.

2. All frames are to be assembled so that the face miter seam is "closed and tight". Weld the face seam and the full web of the frame corner or intersection. Grind and dress smooth the weld area. Apply a zinc rich primer over the grinding area, and finish with a matching prime paint.

B. Fabrication

1. General design and construction

a. Provide steel frames for doors, transoms, sidelights, borrowed lites, and other openings to the size and design as shown on the architectural drawings.

b. All finished work shall be strong and rigid, neat in appearance square, true and free of defects, warp or buckle.

c. Jamb depths, trim, profile and backbends shall be as scheduled by the architect and shown on approved shop drawings.

d. Hardware reinforcements are to be in accordance with the minimum standard gages as listed in SDI-100.

f. Frames shall be mortised, reinforced, drilled and tapped at the factory for template mortised hardware only, in accordance with approved hardware schedule and template provided by the hardware contractor. Where surface mounted hardware is to be applied, frames shall have reinforcing plates only; all drilling and tapping shall be done by others.

C. Anchors

1. Floor anchors shall be provided at each jamb.

2. Anchors for installation in masonry walls shall be of the "T" type.

3. Anchors for installation in stud partitions shall be steel of a suitable design, not less than 18 gauge thickness, insert type with notched clip to engage stud inserted in back of the frame.

4. Dust boxes or mortar guards shall be no less than 26 gage on frames to be set in masonry or on strike mortises in drywall or plaster partitions.

5. Loose glazing stops shall be of galvanized steel, not less than 16 gage, butted at corner joints and secured to the frame with countersunk cadmium or zinc-plated screws.

6. Drill stop to receive three silencers on single-door frames and 2 silencers on double-door frames.

2.07 Prime finish:

A. Doors and frames are to be thoroughly cleaned, and chemically treated to insure maximum finish paint adhesion. All surfaces of the door and frame exposed to view shall receive a factory applied coat of rust inhibiting primer. The finish shall meet the requirements for acceptance stated in ANSI A224.1 "Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces." The prime finish is not intended to be the final layer of protection from the elements. Field painting using a good grade of oil base paints shall be provided in accordance with the recommendations of the door and frame manufacturer. For specialty types of finished coatings, the paint supplier should also be consulted.

PART 3: EXECUTION

3:01 Inspection

It is the responsibility of the General Contractor to assure that scratches are properly cleaned and touched up with a rust inhibiting primer.

3:03 Installation:

A. Door Frames

1. Prior to installation, all frames must be checked for rack, twist and out of square conditions.

2. Place frames prior to enclosing walls and ceilings. Set frames accurately in position, plumbed and braced securely until permanent anchors are set. Remove shipping bar spreader and insert a wood spreader cut to the size of the opening width, notched to clear the frame stops.

3. Fill frames in masonry walls with mortar.

4. When temperature conditions necessitate an additive to be used in the plaster or mortar to prevent freezing, the contractor installing the frames shall coat the inside of the frames, in the field, with a corrosion inhibiting bituminous material.

5. SDI-105, "Recommended Erection Instructions for Steel Frames" and SDI-110 "Standard Steel Doors and Frames for Modular Masonry Construction" shall indicate the proper installation procedures.

6. Install fire-rated frames in accordance with NFPA 80

B. Doors

1. Install doors plumb and in true alignment in a prepared opening and fasten them to achieve the maximum operational effectiveness and appearance.

2. Proper door clearance must be maintained in accordance with SDI-110.

3. Where necessary, metal hinge shims are acceptable to maintain clearances.

4. "Installation Guide for Doors and Hardware" published by DHI is recommended for further details.

C. Hardware must be applied in accordance with hardware manufacturer's templates and instructions.

3.03 Adjust and Clean

A. Final adjustments

Check and re-adjust operating finish hardware items in hollow metal work just prior to final inspection. Leave work in complete and proper condition.

B. Prime Coat Touch-Up

1. Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply to touch-up or compatible air-drying primer.

3:04 Schedules

A. After installation, copies of the door schedules shall be placed in a file folder to be turned over to the owner when the building is accepted.

END OF SECTION

SECTION 08110 - STEEL DOORS AND FRAMES

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes steel doors and frames.

1.2 SUBMITTALS

A. Product Data: For each product indicated. Include door designation, type, level and model, material description, label compliance, fire-resistance ratings, and finishes.

B. Door Schedule. Use same reference designations indicated on Drawings.

C. Provide minimum design wind pressure for all the exterior doors & windows shall be:
+43 psf toward the surface
-54 psf away from the surface

1.3 QUALITY ASSURANCE

A. Steel Door and Frame Standard: Comply with ANSI A 250.8, unless more stringent requirements are indicated.

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.

C. Exterior Doors Assemblies: Approved system tested by Texas Department of Insurance for Windstorm – Inland 1, Miami Dade or TDI approved testing laboratory.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers, Commercial: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Amweld Building Products, Inc.
2. Ceco Door Products; a United Dominion Company.
3. Copco Door Co.
4. Curries Company.
5. Kewanee Corporation (The).
6. Republic Builders Products.
7. Steelcraft; a division of Ingersoll-Rand.

2.2 MATERIALS

A. Hot-Rolled Steel Sheets: ASTM A 569/A 569M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

B. Cold-Rolled Steel Sheets: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness.

2.3 DOORS

A. Interior Doors as scheduled on the drawings: Complying with ANSI 250.8 for level and model and ANSI A250.4 for physical-endurance level indicated.

1. Level 1 and Physical Performance Level C, Model 1 (Full Flush).

B. Exterior Doors as scheduled on the drawings: Complying with ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level indicated.
   1. Level 1 and Physical Performance Level C, Model 1 (Full Flush).

2.4 FRAMES

A. General: ANSI A250.8; conceal fastenings, unless otherwise indicated.
B. Frame Aluminum where detailed (see Storefront Aluminum specifications)
   And/or Steel Sheet Thickness:
   1. 0.042-inch-(1.0-mm-) for level 1 steel doors and wood doors.
   2. 0.053-inch-(1.3-mm-) for all exterior openings and interior openings wider than 48 inches(1220 mm) and level 3 steel doors.
C. Door Silencers: Three silencers on single-door frames and two silencers on double-door frames.
D. Plaster Guards: 0.016-inch-(0.4-mm-) thick, steel sheet plaster guards or mortar boxes to close off interior of openings.
E. Supports and Anchors: Not less than 0.042-inch-(1.0-mm-) thick zinc-coated steel sheet.
   1. Masonry Wall Anchors: 0.177-inch-(4.5-mm-) diameter, steel wire complying with ASTM A 510(ASTM A 510M) may be used in place of steel sheet.
F. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Zinc-coat items that are to be built into exterior walls according to ASTM A 153/A 153M, Class C or D as applicable.

2.5 FABRICATION

A. General: Fabricate steel door and frame units to comply with ANSI A250.8 free from defects including warp and buckle. Where practical, fit and assemble units in manufacturer's plant.
B. Exterior Doors: Fabricate doors, panels, and frames from metallic-coated steel sheet. Close top and bottom edges of doors flush as an integral part of door construction or by addition of 0.053-inch-(1.3-mm-) thick, metallic-coated steel channels with channel webs placed even with top and bottom edges.
C. Interior Door and Panel Faces: Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from cold-rolled steel sheet.
D. Core Construction: Manufacturer's standard core construction that produces a door complying with SDI standards.
E. Clearances for Non-Fire-Rated Doors: Not more than 1/8 inch(3.2 mm) at jambs and heads, except not more than 1/4 inch(6.4 mm) between pairs of doors. Not more than 3/4 inch(19 mm) at bottom.
F. Clearances for Fire-Rated Doors: As required by NFPA 80.
G. Door-Edge Profile: Beveled edge.
H. Tolerances: Comply with SDI 117.
I. Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements in ANSI A250.6 and ANSI A115 Series specifications for door and frame preparation for hardware.
J. Frame Construction:
   1. Fabricate frames with mitered or coped and continuously welded corners and seamless face joints. Provide temporary spreader bars.
   2. Fabricate knock-down frames with mitered or coped corners, for field assembly.
   3. Fabricate knock-down, drywall slip-on frames for in-place gypsum board partitions.
K. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.
L. Locate hardware as indicated or, if not indicated, according to ANSI A250.8.

M. Glazing Stops: Manufacturer's standard, formed from 0.032-inch-(0.8-mm-) thick steel sheet.
   1. Provide non-removable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.
   2. Provide screw-applied, removable, glazing stops on inside of glass, louvers, and other panels in doors.

N. Astragals: As required by NFPA 80 to provide fire ratings indicated.

2.6 FINISHES

A. Prime Finish:
   1. Uncoated steel: Manufacturer's standard, factory-applied coat of rust-inhibiting primer complying with ANSI A250.10 for acceptance criteria.
   2. Coated (galvanized or galvannealed) steel will not be factory primed painted.

PART 3 – EXECUTION

2.1 INSTALLATION

A. Placing Frames: Comply with provisions in SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
   1. Wall Anchors: Provide at least three anchors per jamb. For openings 90 inches(2286 mm) or more in height, install an additional anchor at hinge and strike jambs.
   2. Gypsum Board Partitions: For in-place partitions, install knock-down, drywall slip-on frames.
   3. Fire-Rated Frames: Install according to NFPA 80.

B. Door Installation: Comply with ANSI A250.8. Shim as necessary to comply with SDI 122 and ANSI/DHI A115.1G.
   1. Fire-Rated Doors: Install within clearances specified in NFPA 80.
   2. Smoke Control Doors: Install to comply with NFPA 105.

C. After installation, remove protective wrappings from doors and frames and touch up prime coat with compatible air-drying primer.

END OF SECTION

SECTION 08200 - ARCHITECTURAL FLUSH WOOD DOORS

PART 1 GENERAL

1.01 WORK under this section comprises of furnishing and installing wood doors.

1.02 RELATED DOCUMENTS, drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 specification sections, apply to this section.

1.03 RELATED SECTIONS

A. Section 08100 - Aluminum Door Frames
B. Section 08110 - Hollow Metal
C. Section 08710 - Finish Hardware
D. Section 08800 - Glass and Glazing
E. Section 09900 - Painting

1.04 REFERENCES

A. National Fire Protection Association (N.F.P.A.)
B. Architectural Woodwork Institute (A.W.I.)
C. National Wood Window and Door Association (N.W.W.D.A.)
D. Underwriters' Laboratory, Inc. (U.L.)
E. Warnock Hersey International (W.H.I.)

1.05 SUBMITTALS

A. Shop drawings; Indicate door elevations and sections, materials, thickness, door swing, stile and rail dimensions, veneers, undercuts, storage and erection details, locations of finish hardware by dimension and locations/details of all openings and louvers. Do not proceed with any fabrication until all details are approved.
B. Submit any information necessary to indicate compliance to any or all of these specifications as requested.
C. Submit samples of veneer and door construction.
D. All labeled fire door assemblies shall be of a type which have been classified and listed in accordance with the latest edition of A.N.S.I./N.F.P.A. 80 and tested in compliance with A.S.T.M.-E152, N.F.P.A.-252, and U.L.-10B. A physical label shall be permanently affixed to the fire door at an authorized facility. Furthermore, all 'B' and 'C' label fire doors are to have manufacturers' standard laminated stiles for improved screw holding and split resistance capabilities.

1.06 QUALITY ASSURANCE

A. Wood door supplier to be a qualified direct distributor of products to be furnished. In addition the distributor to have in their regular employment an A.H.C./C.D.C. or person of equivalent experience who is to be made available at reasonable times to consult with the architect/contractor and/or owner regarding any matters affecting the wood doors in this project.

B. Obtain doors from a single manufacturer to ensure uniformity in quality of appearance and construction. All material supplied for this project shall conform to the A.W.I. Sections 200 and

1300 for premium grade wood doors.

1.07 DELIVERY, STORAGE AND HANDLING

A. Protect doors during transit, storage and handling to help prevent damage, soiling and deterioration.
B. Comply with manufacturer's instructions and with "on-site-care" requirements of A.W.I. Section 1300-G-8 "Care and handling at site".
C. Deliver prefinished components in manufacturer's original unopened protective covering or container, clearly marked with manufacturer's name, brand name and identifying number on the covering.
D. Do not walk or stack other materials on top of stacked doors. Do not drag doors across one another.
E. For all doors not factory finished - seal all four edges immediately after delivery.

1.08 PROJECT/SITE CONDITIONS

A. Deliver doors to jobsite only after "wet" construction operations are completed.
B. Building to be dry and have reached average prevailing relative humidity of locality.

1.09 WARRANTY

A. Submit written warranty on manufacturer's standard form signed by an official of the door manufacturer agreeing to repair or replace defective doors which have;
1. Delamination in any degree.
2. Warp or twist of 1/4" or more in any 3'-6" x 7'-0" plane of door face.
3. Telegraphing of stile, rail or core through face to cause surface variation in excess of 1/100" in any 3" span.

B. When hanging doors, do not subject them to extremes of heat and/or humid conditions. Relative humidity shall not be less than 30% nor more than 60%.
C. Warranty to include refinishing and reinstallation which may be required due to repair or replacement of defective doors.
D. Warranty to be in effect for life of the original installation.
E. Warranty not to be in effect for any field finished doors not having been sealed properly on all edges and faces.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Specific products or materials manufactured by any of the following listed manufacturers are "acceptable", not approved), only if the specific product or material can evidence exact compliance with the contract documents (see "Materials" Section 2.02).
B. Algoma Hardwoods, Inc., Algoma, Wisconsin
C. Eggers Industries, Architectural Door Div., Neenah, Wisconsin.
D. Graham Manufacturing Corp., Mason City, Iowa
E. Vancouver Doors, Puyallup, Washington

2.02 MATERIALS

A. Wood Door Faces
1. Manufacturer's Standard 2 or 3 ply faces.

2. Utilize A.W.I. Premium grade veneer per A.W.I. Section 200 and A.N.S.I./H.P.M.A. grading rules.
3. Minimum 1/50" thick veneer
4. Domestically assembled plain sliced natural birch veneer

B. Adhesive
1. Bond door faces to cores, stiles and rails.
2. Interior doors use minimum Type II ANSI\NWWDA I. S.-1 Series.

C. Door Core, nonrated and 20 minute rated
1. Particleboard core complying to A.N.S.I./A208.1 Grade 1-LD-2
2. Bonded to outer stiles and rails

D. Vertical stiles, nonrated and 20 minute rated
1. Matching hardwood outer stile edge, 9/16" minimum before trim
2. Overall stiles 1 3/8" minimum after trim

E. Rail edges, nonrated and 20 minute rated
1. Mill option, softwood or hardwood
2. 2" minimum after trim

F. Labeled Fire Door Core, 45 minute, 1 hour, 1 1/2 hour
1. Noncombustible mineral
2. Containing no asbestos

G. Vertical stiles, 45 minute, 1 hour, 1 1/2 hour rated doors
1. Visually compatible with face veneer
2. Minimum 1 1/8" thick
3. Laminated for improved screw holding and split resistance
4. Matching edges are required

H. Rail edges, 45 minute, 1 hour, 1 1/2 hour
1. Top rail 1 1/4" minimum
2. Bottom rail 1 1/2" minimum
3. Containing no asbestos

2.03 FIELD FINISHING

A. Finish all wood doors in accordance with Division 9

2.04 PREFITTING AND PREPARATION FOR HARDWARE

A. Prefit and premachine all wood doors at factory.
B. Premachine doors in accordance with final approved hardware and frame schedule.
C. Fire doors shall be machined in strict compliance of NFPA-80 latest edition.
D. Premachine doors within industry tolerances. A plus or minus 1/32" will be allowed on all hardware locations. A plus 1/32" minus 1/64" tolerance will be allowed on lock front preparation cutouts.

2.05 A. GENERAL
1. Comply with AWI Quality Standards Section 1300 for premium grade wood doors, except to meet or exceed requirements herein specified.
2. Completely factory prefit to required size ready for installation at project site; no on-jobsite trimming permitted.
3. Prepare in accordance with frame shop drawings and schedule, hardware schedule and templates.

B. Thickness; 1 3/4" thick unless indicated otherwise on door schedule.
C. Transom Panels

1. Provide transom panels which match and continue grain of door.
2. Provide concealed fastening system.

PART 3 EXECUTION

3.01 PREPARATION

A. Examine door frames and verify frames are of correct type and have been installed for proper hanging of corresponding doors.

3.02 INSTALLATION

A. Install in accordance with manufacturer's written instructions.
B. Install fire doors in accordance with NFPA-80, 1992.
C. Install accurately in frame, within clearances specified. Install hardware in accordance with manufacturer's written instructions and associated templates. Refer to Section 08710 for general installation requirements if specified.
D. Do not field cut doors to opening sizes smaller than those for which doors were manufactured. Do not install door in frame set out of plumb or square.
E. Install to operate freely, but not loosely, free from hinge bound conditions, striking or binding. Do not install in frames which would hinder operation of doors. Hang free from rattling when in latched position.
F. Pilot holes to be drilled for screws attaching hinges, lock hardware and all other devices to the stile or face of wood doors. Pilot holes shall not exceed 90% of the root diameter of the screw.

3.03 ADJUSTING

A. Adjust and check each door to ensure proper operating and function.
B. Replace or rehang doors which are hinge bound and do not swing or operate freely. Replace or rehang doors which are warped, twisted, or which are not in true planes.

END OF SECTION

SECTION 08520 - ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data, Shop Drawings, and color Samples.

PART 2 - PRODUCTS

2.1 ALUMINUM WINDOWS

A. Alenco

B. Provide aluminum windows that comply with AAMA/NWWDA 101/I.S.2.
   1. Single-Hung Window Product
   2. Horizontal-Sliding Window Product
   3. Fixed Window Product
   4. Provide AAMA-certified aluminum windows with an attached label.
   5. Provide units with a concealed, thermal barrier that eliminates direct metal-to-metal contact and with condensation resistance factor of 45 and a U-value of 0.69 Btu/sq. ft. x h x deg F (3.9 W/sq. m x K) at 15-mph (24-km/h) exterior wind velocity per AAMA 1503.1.
   6. Provide units to meet or exceed **TDI Inland 1 Windstorm requirements for the State of Texas as required for the Local jurisdiction IMPACT RESISTANT**.
   7. Equip units with insect screens at operable sashes.

C. Glaze units with Low E sealed insulating glass.

D. The exterior doors & windows shall be designed for the following wind pressures:
   P+ (towards the surface) +43 psf
   P- (away from the surface) -54 psf

E. Finish: Class I, clear anodic finish; AA-M12C22A41; complying with AAMA 607.1

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set units level, plumb, and true to line, without warp or rack of frames and panels and anchor securely in place.

B. Set sill members in bed of sealant or with gaskets, as indicated, to provide weather tight construction.

C. Adjust operating panels, screens, and hardware for smooth operation and weather tight closure. Lubricate hardware and moving parts.

END OF SECTION

SECTION 08 71 00 - FINISH HARDWARE

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Work under this section comprises of furnishing hardware specified herein and noted on drawings for a complete and operational system, including any electrified hardware components, systems, controls and hardware for aluminum entrance doors. Any door shown on the drawing and not specifically referenced in the hardware sets shall be provided with identical hardware as specified on other similar openings and shall be included in the General Contractor's base bid. All fire rated door shall be provided with fire rated hardware as required by local code Authority as part of the General Contractor's base bid. The hardware supplier shall verify all cylinder types specified for locking devices supplied as part of the door system with the door manufacturer and/or door supplies.

B. The General Contractor shall notify the Architect in writing of any discrepancies (five (5) days prior to bid date) that could and/or would result in hardware being supplied that is none functional, hardware specified and/or hardware that has not been specified that will result in any code violations and any door that is not covered in this specification. Failure of the General Contractor to address any such issue could be considered acceptance of the hardware specified and all discrepancies could be corrected at the General Contractor's expense.

C. Items include but are not limited to the following:

1. Hinges - Pivots
2. Flush Bolts
3. Exit Devices
4. Locksets and Cylinders
5. Push Plates - Pulls
6. Coordinators
7. Closers
8. Kick, Mop and Protection Plates
9. Stops, Wall Bumpers, Overhead Controls
10. Electrified Hold Open Devices
11. Thresholds, Seals and Door Bottoms
12. Silencers
13. Miscellaneous Trim and Accessories

1.02 RELATED DOCUMENTS, drawings and general provisions of contract, including General and Supplementary Conditions, and Division 1 Specification sections, apply to this section.

1.03 RELATED WORK specified elsewhere that should be examined for its effect upon this section:

A. Section 06 20 00 - Finish Carpentry
B. Section 08 11 13 – Steel Doors and Frames
C. Section 08 14 16 – Flush Wood Doors
D. Sections 08 31 13 – Access Doors
E. Section 08 39 00 – Watertight Doors
E. Section 08 41 13 – Aluminum Entrances, Storefront and Window Framing
F. Sections 08 80 00 – Glass and Glazing
G. Sections 09 91 00 - Painting

H. Division 26 – Electrical
I. Division 28 – Access Control

1.04 REFERENCES SPECIFIED in this section subject to compliance as directed:

A. NFPA-80 - Standard for Fire Doors and Windows
B. NFPA-101 - Life Safety Code
C. ADA - The Americans with Disabilities Act - Title III - Public Accommodations
D. ANSI-A 117.1 - American National Standards Institute - Accessible and Usable Buildings and Facilities
E. ANSI-A 156.5 - American National Standards institute -Auxiliary Locks and Associated Products
F. UFAS - Uniform Federal Accessibility Standards
G. UL - Underwriter's Laboratories
H. WHI - Warnock Hersey International, Testing Services
I. State and Local Codes including Authority Having Jurisdiction
J. UL10C – Positive Pressure
K. IBC-2015 – International Building Code
L. NFPA-70 – International Electrical Code

1.05 SUBMITTALS

A. HARDWARE SCHEDULES submit copies of schedule in accordance with Division 1, General Requirements. Schedule to be in vertical format, listing each door opening, including: handing of opening, all hardware scheduled for opening or otherwise required to allow for proper function of door opening as intended, and finish of hardware. At doors with door closers or door controls include degree of door opening. Supply the schedules all Finish Hardware within two (2) weeks from date purchase order is received by the hardware supplier.

B. Submit manufacturer's cut/catalog sheets on all hardware items and any required special mounting instructions with the hardware schedule.

C. Certification of Compliance:

1. Submit any information necessary to indicate compliance to these specifications as required.
2. Submit a statement from the manufacturer that electronic hardware and systems being supplied comply with the operational descriptions exactly as specified.

D. Submit any samples necessary as required by the Architect.

E. Templates for finish hardware items to be sent to related door and frame suppliers within three (3) working days of receipt of approved hardware schedule.

F. Doors and Frames used in positive pressure opening assemblies shall meet UL10C in areas where this specification includes Seals for smoke door.

1.06 QUALITY ASSURANCE

A. Hardware supplier to be a qualified, Factory Authorized, direct distributor of the products to be furnished. In addition, the supplier to have in their regular employment an AHC or AHC /CDC and/or a person of equivalent experience (minimum fifteen (15) years in the industry) who will be made available at

reasonable times to consult with the Architect/Contractor and/or the Owners Representative regarding any matters affecting the finish hardware on this project.

B. All hardware used in labeled fire or smoke rated openings to be listed for those types of openings and bear the identifying label or mark indicating UL. (Underwriter's Laboratories) approved for fire. Exit devices in non-labeled openings to be listed for panic.

1.07 DELIVERY, HANDLING AND PACKAGING

A. Furnish all hardware with each unit clearly marked and numbered in accordance with the hardware schedule. Include door and item number for each.

B. Pack each item of hardware completes with all necessary parts and fasteners.

C. Properly wrap and cushion each item to prevent scratches and dents during delivery and storage.

1.08 SEQUENCING AND SCHEDULING

Any part of the finish hardware required by the frame or door manufacturers or other suppliers that is needed to produce doors or frames is to be sent to those suppliers in a timely manner, so as not to interrupt job progress.

1.09 WARRANTY

All finish hardware shall be supplied with a one- (1) year warranty against defects in materials and workmanship, commencing with substantial completion of the project except as follows:

1. All Closers shall have a twenty-five- (25) year written warranty.
2. All "ND" Locksets shall have a ten- (10) year written warranty.
3. All Electronic Locksets shall have a two (2) year written warranty.
4. All Exit Devices shall have a three (3) year written warranty.
5. All Continuous Hinges shall have a ten-(10) year written warranty.

PART 2 – PRODUCTS

2.01 FASTENERS

A. Furnish with finish hardware all necessary screws, bolts and other fasteners of suitable size and type to anchor the hardware in position for a long life under hard use.

B. Furnish fastenings where necessary with expansion shields, toggle bolts and other anchors designated by the Architect according to the material to which the hardware is to be applied and the recommendations of the hardware manufacturer. All closers and exit devices on labeled wood doors shall be through-bolted if required by the door manufacturer. All thresholds shall be fastened with wood screws and plastic anchors. Where specified in the hardware sets, security type fasteners of the type called for are to be supplied.

C. Design of all fastenings shall harmonize with the hardware as to material and finish.

D. All hardware shall be installed with the Manufacturers standard screws as provided. The use of any other type of fasteners shall not be permitted. The general contractor shall provide wood blocking in all stud walls specified and/or scheduled to receive wall stops, No Exception.

2.02 ENVIRONMENTAL CONCERN FOR PACKAGING

The hardware shall ship to the job site is to be packaged in biodegradable packs such as paper or cardboard boxes and wrapping.

2.03 HINGES

A. All hinges to be of one manufacturer as hereafter listed for continuity and consideration of warranty. Provide one of the following manufacturers Ives, Hager, Mc Kinney or Stanley.

B. Unless otherwise specified provide five-knuckle, heavy-duty, button tip, full mortise template type hinges with non-rising loose pins. Provide non-removable pins for out swinging doors at secured areas or as called for in this specification (Refer to 3.02 Hardware Sets).

C. Provide all out-swinging doors with non-removable pins or security studs as called for in 3.02 Hardware Sets. Furnish three (3) hinges up to 90 inches high and one (1) additional hinge for every 30 inches or fraction thereof.

D. Furnish three (3) hinges up to 90 inches high and one (1) additional hinge for every 30 inches or fraction thereof.

E. Provide size 4½" x 4½" for all 1¾" thick doors up to and including 36 inches wide. Doors over 1¾" through 2¼" thick, use 5" x 5" hinges. Doors over 36 inches use 5" x 4½" unless otherwise noted in 3.02 Hardware Sets.

F. Were required to clear the trim and/or to permit the doors to swing 180 degrees furnish hinges of sufficient throw.

G. Provide heavy weight hinges on all doors over 36 inches in width.

H. At labeled door's steel or stainless steel, bearing-type hinges shall be provided. For all doors equipped with closers provide bearing-type hinges.

2.04 LOCK AND LOCK TRIM

A. All the locksets, latch sets, and trim to be of one manufacturer as hereafter listed for continuity of design and consideration of warranty. Locksets specified are Schlage "ND" series with the Rhodes levers and shall be provided as specified.

B. Provide metal wrought box strike boxes and curved lip strikes with proper lip length to protect trim of the frame, but not to project more than 1/8 inch beyond frame trim or the inactive leaf of a pair of doors.

C. Mechanical Locks shall meet ANSI Operational Grade 1, Series 4000 as specified.

1. Hand of lock is to be field reversible or non-handed.
2. All lever trim is to be through-bolted through the door.

2.05 CYLINDERS AND KEYING

A. Provide all exterior and interior locks or Exit Devices requiring cylinders keyed to the New Everest Master Key System as instructed by the Owners Representative. Cylinders shall comply with performance requirements of ANSI A156.5. All keys shall be of nickel silver material only. The hardware supplier shall meet with the General Contractor, the Architect and the Owners Representative at the project jobsite to determine all permanent keying requirements.

B. Cylinders shall be factory keyed and factory maintained as directed by the owners Representative and the Architect. Provide three- (3) keys per cylinder and six- (6) master keys per master used.

C. Factory stamp all keys “Do not duplicate” and with key symbol as directed by the Owners Representative. Visual key control shall be provided on all permanent keys and cylinders.

2.06 EXIT DEVICES

A. All exit devices and trim, including electrified items, to be of one manufacturer as hereafter listed and in the hardware sets for continuity of design and consideration of warranty; electrified devices and trim to be the same series and design as mechanical devices and trim.

B. Exit Devices to be “UL” listed for life safety. All exit devices for labeled doors shall have “UL” label for “Fire Exit Hardware”. All devices mounted on labeled wood doors are to be through-bolted or per the manufacturer’s listing requirements. All devices shall conform to NFPA 80 and NFPA 101 requirements.

C. All exit devices to be of a heavy duty, chassis mounted design, with a one-piece removable cover, eliminating necessity of removing the device from the door for standard maintenance and keying requirements.

D. All trims to be through-bolted to the lock stile case. Lever design to be the same as specified with the lock sets.

E. Exit Devices shall be the modern push rail design. All exit devices shall be mounted with sex bolts and installed with the manufactures standard screws. Exit Hardware Devices found to be installed with self-drilling and self-tapping screws shall be removed and reinstalled at the installer expenses.

F. All devices shall carry a three- (3) year warranty against manufacturing defects and workmanship.

G. Furnish roller strikes for all rim and surface vertical rod exit devices. Internal springs shall be coil compression type. Furnish security dead latching for all active latch bolts.

H. All Exit Devices shall be field modifiable as incorporate an Electric Latch Retraction Feature without the purchase of new Panic Exit Hardware.

J. Exit Devices shall be the Von Duprin “99” series as specified.

2.07 SURFACE MOUNTED DOOR CLOSERS

A. All closers for this project shall be the products of a single manufacturer for continuity of design and consideration of warranty. All door closers shall be mounted as to achieve the maximum degree of opening (trim permitting).

B. All closers to be heavy duty, surface-mounted, fully hydraulic, rack and pinion action with high strength case iron cylinder to provide control throughout the entire door opening and closing cycle.

C. Size all closers in accordance with the manufacturer's recommendations at the factory.

D. All closers to have adjustable spring power sizes 1 or 2 through 4 or 6 and non-critical regulating screw valves for closing speed, latching speed and back-check control as a standard feature unless specified otherwise.

E. Provide closer covers only if provided as a standard part of the door closer package.

F. The hardware supplier shall provide all required brackets, spacers or filler plates as required by the manufacture for a proper and functional installation as part of their base bid.

G. Supply appropriate arm assembly for each closer so that closer body and arm are mounted on non-public side of door opening and on the interior side of exterior openings, except where required otherwise in the hardware sets.

H. Provide drop plates and any additional mounting brackets required for the proper installation of the door closer shall be included in the hardware supplier's base bid.

I. Finish: Baked on Powder Coated finish shall match other hardware.

J. Provide and mount all door closers with sex bolts as provided by the manufacturer.

K. Closers shall be LCN "1250" series as specified or acceptable products manufactured by Sargent "281" series.

2.08 DOOR STOPS AND HOLDERS

A. Door stops are to be furnished for every door leaf. Every door is to have a floor, wall, or an overhead stop.

B. Place doorstops in such a position that they permit maximum door swing, but do not present a hazard of obstruction. Furnish floor strikes for floor holders of proper height to engage holders of doors.

C. Where overhead stops and holders are specified, or otherwise required for proper door operation, they are to be heavy duty and of extruded brass, bronze or stainless steel with no plastic parts as specified**.** The General Contractor shall provide wood blocking in all stud walls specified and scheduled to receive wall stops.

D. Finish: Shall match other hardware where available.

E. Acceptable Products

1. Floor and wall stops as listed in hardware sets. Equivalent products as manufactured by Ives, ABH and Trimco are acceptable.

2.09 PUSH PLATES, DOOR PULLS, AND KICKPLATES

A. All push plates, door pull, kick plates and other miscellaneous hardware as listed in hardware sets. Equivalent products as manufactured by Ives, Hager and Trimco are acceptable.

B. Kick plates to be 10 inches high and Mop plates to be 6 inches high, both by 1-½ inches or 1 inch less than door width (LDW) as specified. They are to be of 16-gauge thick base metal. For door with louvers or narrow bottom rails, kick plate height to be 1 inch less dimension shown from the bottom of the door to the bottom of the louver or glass.

C. Where required armor plates, edge guards and other protective hardware shall be supplied in sizes as scheduled in the hardware sets.

D. Finish: Same as other hardware where available.

2.10 FLUSH BOLTS AND COORDINATORS

A. Provide Flush bolts with Dust Proof Strikes as indicated in the individual hardware sets by Ives, Hager and Trimco are acceptable. Finish shall match the adjacent hardware.

2.11 THRESHOLDS AND SEALS

A. Provide materials and finishes as listed in hardware sets. Zero products have been specified to set a high level of quality, equivalent product by manufactured by National Guard Products and Pemko shall be acceptable. All thresholds must be in accordance with the requirements of the ADA and ANSI A117.1.

B. Provide thresholds with wood screws and plastic anchors. Supply all necessary anchoring devices for weather strip and sound seal.

C. Seals shall comply with requirements of UL10C. All thresholds, door bottoms and weather strip inserts shall be a silicone based product as specified in 3.02 Hardware Sets. Other materials used shall be rejected, unless originally specified.

D. Seals shall comply with the requirements of the Wood Door Manufacturer’s certification requirements.

2.12 FINISHES

A. Finishes for all hardware are as required in this specification and the hardware sets.

B. Special care is to be taken to make uniform the finish of all various manufactured items.

2.13 DOOR SILENCERS

A. Provide door silencers at all openings without gasket. Provide two- (2) each at pair of doors and three- (3) or four- (4) each for each single door (coordinate with the frame manufacturer).

2.15 PROPRIETARY PRODUCTS

A. References to specific products are used to establish quality standards of utility and performance. Unless otherwise approved provide only the specified product.

B. All other materials, not specifically described, but required for a complete and proper finish hardware installation, are to be selected by the Contractor, subject to the approval of the Architect and the Owners Representative.

C. Architect and the Owners Representative reserve the right to approve all the substitutions proposed for this specification. All requests for substitution to be made prior to bid in accordance with Division 1, General Requirements, and are to be in writing, hand delivered to the Architect. Two (2) copies of the manufacturer's brochures and a physical sample of each item in the appropriate design and finish shall accompany requests for substitution.

PART 3 - EXECUTION

3.01 INSTALLATION AND SERVICE ITEMS OF FINISH HARDWARE

A. All finish hardware shall be installed by an experienced finish hardware installer with at least ten (10) years of experience after a pre-installation meeting between the contractor, hardware Manufacturers representative, the hardware supplier, the hollow metal supplier and the wood door supplier. The finish hardware installer shall be responsible for the proper installation and function of all doors and hardware.

B. The hardware supplier's office and/or warehouse shall be located within a one hundred twenty-five (125) mile radius of the project site as to better service the general contractor and the Owners Representative during this project.

C. Check hardware against the reviewed hardware schedule upon delivery. Store the hardware in a dry and secure location to protect against loss and damage.

D. Install finish hardware in accordance with approved hardware schedule and manufacturers' printed instructions. Pre-fit hardware before finish is applied to door; remove and reinstall after finish is complete and dry. Install and adjust hardware so that parts operate smoothly, close tightly, and do not rattle.

E. Mortise and cutting to be done neatly, and evidence of cutting to be concealed in the finished work. Protect all Finish hardware from scratching or other damage.

3.02 HARDWARE SETS

SPEXTRA: 433190
HARDWARE GROUP NO. 01
FOR USE ON MARK/DOOR #(S):
1

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONTINUOUS HINGE	112XY-DOOR HEIGHT	628	IVE

1	EA	PANIC HARDWARE	99-EO-SNB	628	VON
1	EA	EXIT DEVICE TRIM	AD-200-993R-70-MTK-RHO-PD-8B	626	SCE
1	EA	SURFACE CLOSER	1250 SCUSH SLIM	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA-40"	AA	ZER
1	EA	GASKETING	8303AA-HEAD & JAMBS	AA	ZER
1	EA	DOOR SWEEP	50MAA-36"	AA	ZER
1	EA	THRESHOLD	65A-223-36" (914MM)	A	ZER

HARDWARE GROUP NO. 02

FOR USE ON MARK/DOOR #(S):
2

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	PANIC HARDWARE	99-EO-SNB	628	VON
1	EA	EXIT DEVICE TRIM	AD-200-993R-70-MTK-RHO-PD-8B	626	SCE
1	EA	SURFACE CLOSER	1250 EDA SLIM	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS410	626	IVE
3	EA	SILENCER	SR64	GRY	IVE
50	EA	CREDENTIAL	9420	GWT	SCE
1	EA	ACCESSORIES	HHD-KIT-USB		SCE

HARDWARE GROUP NO. 03

FOR USE ON MARK/DOOR #(S):
3 4

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	HOSPITAL PRIVACY	ND44S RHO	626	SCH
1	EA	SURFACE CLOSER	1250 RW/PA SLIM	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	COAT HOOK	582	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 04

FOR USE ON MARK/DOOR #(S):
5

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE

2	EA	MANUAL FLUSH BOLT	FB458	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	ND80PD RHO	626	SCH
2	EA	OH STOP	450S	630	GLY
1	EA	STRIKE ASTRAGAL	43SP-DOOR HEIGHT (PULL SIDE MOUNTED)	SP	ZER
2	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 05

FOR USE ON MARK/DOOR #(S):
6

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM LOCK	ND70PD RHO	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 06

FOR USE ON MARK/DOOR #(S):
7

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRANCE LOCK	ND53PD RHO	626	SCH
1	EA	FLOOR STOP	FS410	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 07

FOR USE ON MARK/DOOR #(S):
8

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONTINUOUS HINGE	112XY-DOOR HEIGHT	628	IVE
1	EA	PANIC HARDWARE	99-EO-SNB	628	VON
1	EA	EXIT DEVICE TRIM	AD-200-993R-70-MTK-RHO-PD-8B	626	SCE
1	EA	SURFACE CLOSER	1250 SCUSH SLIM	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA-40"	AA	ZER
1	EA	GASKETING	8303AA-HEAD & JAMBS	AA	ZER
1	EA	DOOR SWEEP	50MAA-36"	AA	ZER
1	EA	THRESHOLD	65A-223-36" (914MM)	A	ZER

HARDWARE GROUP NO. 08 – GATES (2 TOTAL)

FOR USE ON MARK/DOOR #(S):
GATES

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	PADLOCK LOCK HOODED MOUNTING BOX	KS43F2200 X 23-065 CYLINDER PROVIDED BY THE GATE SUPPLIER	606	SCH

END OF SECTION

SECTION 08 71 00 - FINISH HARDWARE

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Work under this section comprises of furnishing hardware specified herein and noted on drawings for a complete and operational system, including any electrified hardware components, systems, controls and hardware for aluminum entrance doors. Any door shown on the drawing and not specifically referenced in the hardware sets shall be provided with identical hardware as specified on other similar openings and shall be included in the General Contractor's base bid. All fire rated door shall be provided with fire rated hardware as required by local code Authority as part of the General Contractor's base bid. The hardware supplier shall verify all cylinder types specified for locking devices supplied as part of the door system with the door manufacturer and/or door supplies.

B. The General Contractor shall notify the Architect in writing of any discrepancies (five (5) days prior to bid date) that could and/or would result in hardware being supplied that is none functional, hardware specified and/or hardware that has not been specified that will result in any code violations and any door that is not covered in this specification. Failure of the General Contractor to address any such issue could be considered acceptance of the hardware specified and all discrepancies could be corrected at the General Contractor's expense.

C. Items include but are not limited to the following:

1. Hinges - Pivots
2. Flush Bolts
3. Exit Devices
4. Locksets and Cylinders
5. Push Plates - Pulls
6. Coordinators
7. Closers
8. Kick, Mop and Protection Plates
9. Stops, Wall Bumpers, Overhead Controls
10. Electrified Hold Open Devices
11. Thresholds, Seals and Door Bottoms
12. Silencers
13. Miscellaneous Trim and Accessories

1.02 RELATED DOCUMENTS, drawings and general provisions of contract, including General and Supplementary Conditions, and Division 1 Specification sections, apply to this section.

1.03 RELATED WORK specified elsewhere that should be examined for its effect upon this section:

A. Section 06 20 00 - Finish Carpentry
B. Section 08 11 13 – Steel Doors and Frames
C. Section 08 14 16 – Flush Wood Doors
D. Sections 08 31 13 – Access Doors
E. Section 08 39 00 – Watertight Doors
E. Section 08 41 13 – Aluminum Entrances, Storefront and Window Framing
F. Sections 08 80 00 – Glass and Glazing
G. Sections 09 91 00 - Painting

H. Division 26 – Electrical
I. Division 28 – Access Control

1.04 REFERENCES SPECIFIED in this section subject to compliance as directed:

A. NFPA-80 - Standard for Fire Doors and Windows
B. NFPA-101 - Life Safety Code
C. ADA - The Americans with Disabilities Act - Title III - Public Accommodations
D. ANSI-A 117.1 - American National Standards Institute - Accessible and Usable Buildings and Facilities
E. ANSI-A 156.5 - American National Standards institute -Auxiliary Locks and Associated Products
F. UFAS - Uniform Federal Accessibility Standards
G. UL - Underwriter's Laboratories
H. WHI - Warnock Hersey International, Testing Services
I. State and Local Codes including Authority Having Jurisdiction
J. UL10C – Positive Pressure
K. IBC-2015 – International Building Code
L. NFPA-70 – International Electrical Code

1.05 SUBMITTALS

A. HARDWARE SCHEDULES submit copies of schedule in accordance with Division 1, General Requirements. Schedule to be in vertical format, listing each door opening, including: handing of opening, all hardware scheduled for opening or otherwise required to allow for proper function of door opening as intended, and finish of hardware. At doors with door closers or door controls include degree of door opening. Supply the schedules all Finish Hardware within two (2) weeks from date purchase order is received by the hardware supplier.

B. Submit manufacturer's cut/catalog sheets on all hardware items and any required special mounting instructions with the hardware schedule.

C. Certification of Compliance:

1. Submit any information necessary to indicate compliance to these specifications as required.
2. Submit a statement from the manufacturer that electronic hardware and systems being supplied comply with the operational descriptions exactly as specified.

D. Submit any samples necessary as required by the Architect.

E. Templates for finish hardware items to be sent to related door and frame suppliers within three (3) working days of receipt of approved hardware schedule.

F. Doors and Frames used in positive pressure opening assemblies shall meet UL10C in areas where this specification includes Seals for smoke door.

1.06 QUALITY ASSURANCE

A. Hardware supplier to be a qualified, Factory Authorized, direct distributor of the products to be furnished. In addition, the supplier to have in their regular employment an AHC or AHC /CDC and/or a person of equivalent experience (minimum fifteen (15) years in the industry) who will be made available at

reasonable times to consult with the Architect/Contractor and/or the Owners Representative regarding any matters affecting the finish hardware on this project.

B. All hardware used in labeled fire or smoke rated openings to be listed for those types of openings and bear the identifying label or mark indicating UL. (Underwriter's Laboratories) approved for fire. Exit devices in non-labeled openings to be listed for panic.

1.07 DELIVERY, HANDLING AND PACKAGING

A. Furnish all hardware with each unit clearly marked and numbered in accordance with the hardware schedule. Include door and item number for each.

B. Pack each item of hardware completes with all necessary parts and fasteners.

C. Properly wrap and cushion each item to prevent scratches and dents during delivery and storage.

1.08 SEQUENCING AND SCHEDULING

Any part of the finish hardware required by the frame or door manufacturers or other suppliers that is needed to produce doors or frames is to be sent to those suppliers in a timely manner, so as not to interrupt job progress.

1.09 WARRANTY

All finish hardware shall be supplied with a one- (1) year warranty against defects in materials and workmanship, commencing with substantial completion of the project except as follows:

1. All Closers shall have a twenty-five- (25) year written warranty.
2. All "ND" Locksets shall have a ten- (10) year written warranty.
3. All Electronic Locksets shall have a two (2) year written warranty.
4. All Exit Devices shall have a three (3) year written warranty.
5. All Continuous Hinges shall have a ten-(10) year written warranty.

PART 2 – PRODUCTS

2.01 FASTENERS

A. Furnish with finish hardware all necessary screws, bolts and other fasteners of suitable size and type to anchor the hardware in position for a long life under hard use.

B. Furnish fastenings where necessary with expansion shields, toggle bolts and other anchors designated by the Architect according to the material to which the hardware is to be applied and the recommendations of the hardware manufacturer. All closers and exit devices on labeled wood doors shall be through-bolted if required by the door manufacturer. All thresholds shall be fastened with wood screws and plastic anchors. Where specified in the hardware sets, security type fasteners of the type called for are to be supplied.

C. Design of all fastenings shall harmonize with the hardware as to material and finish.

D. All hardware shall be installed with the Manufacturers standard screws as provided. The use of any other type of fasteners shall not be permitted. The general contractor shall provide wood blocking in all stud walls specified and/or scheduled to receive wall stops, No Exception.

2.02 ENVIRONMENTAL CONCERN FOR PACKAGING

The hardware shall ship to the job site is to be packaged in biodegradable packs such as paper or cardboard boxes and wrapping.

2.03 HINGES

A. All hinges to be of one manufacturer as hereafter listed for continuity and consideration of warranty. Provide one of the following manufacturers Ives, Hager, Mc Kinney or Stanley.

B. Unless otherwise specified provide five-knuckle, heavy-duty, button tip, full mortise template type hinges with non-rising loose pins. Provide non-removable pins for out swinging doors at secured areas or as called for in this specification (Refer to 3.02 Hardware Sets).

C. Provide all out-swinging doors with non-removable pins or security studs as called for in 3.02 Hardware Sets. Furnish three (3) hinges up to 90 inches high and one (1) additional hinge for every 30 inches or fraction thereof.

D. Furnish three (3) hinges up to 90 inches high and one (1) additional hinge for every 30 inches or fraction thereof.

E. Provide size 4½" x 4½" for all 1¾" thick doors up to and including 36 inches wide. Doors over 1¾" through 2¼" thick, use 5" x 5" hinges. Doors over 36 inches use 5" x 4½" unless otherwise noted in 3.02 Hardware Sets.

F. Were required to clear the trim and/or to permit the doors to swing 180 degrees furnish hinges of sufficient throw.

G. Provide heavy weight hinges on all doors over 36 inches in width.

H. At labeled door's steel or stainless steel, bearing-type hinges shall be provided. For all doors equipped with closers provide bearing-type hinges.

2.04 LOCK AND LOCK TRIM

A. All the locksets, latch sets, and trim to be of one manufacturer as hereafter listed for continuity of design and consideration of warranty. Locksets specified are Schlage "AL" series with the Saturn levers and shall be provided as specified. **Reference Alternate #A1 at the end of the hardware sets for change in lock grade.**

B. Provide metal wrought box strike boxes and curved lip strikes with proper lip length to protect trim of the frame, but not to project more than 1/8 inch beyond frame trim or the inactive leaf of a pair of doors.

C. Mechanical Locks shall meet ANSI Operational Grade 2, Series 4000 as specified.

1. Hand of lock is to be field reversible or non-handed.

2. All lever trim is to be through-bolted through the door.

2.05 CYLINDERS AND KEYING

A. Provide all exterior and interior locks or Exit Devices requiring cylinders keyed to the New Everest Master Key System as instructed by the Owners Representative. Cylinders shall comply with performance requirements of ANSI A156.5. All keys shall be of nickel silver material only. The hardware supplier shall meet with the General Contractor, the Architect and the Owners Representative at the project jobsite to determine all permanent keying requirements.

B. Cylinders shall be factory keyed and factory maintained as directed by the owners Representative and the Architect. Provide three- (3) keys per cylinder and six- (6) master keys per master used.

C. Factory stamp all keys “Do not duplicate” and with key symbol as directed by the Owners Representative. Visual key control shall be provided on all permanent keys and cylinders.

2.06 EXIT DEVICES

A. All exit devices and trim, including electrified items, to be of one manufacturer as hereafter listed and in the hardware sets for continuity of design and consideration of warranty; electrified devices and trim to be the same series and design as mechanical devices and trim.

B. Exit Devices to be “UL” listed for life safety. All exit devices for labeled doors shall have “UL” label for “Fire Exit Hardware”. All devices mounted on labeled wood doors are to be through-bolted or per the manufacturer’s listing requirements. All devices shall conform to NFPA 80 and NFPA 101 requirements.

C. All exit devices to be of a heavy duty, chassis mounted design, with a one-piece removable cover, eliminating necessity of removing the device from the door for standard maintenance and keying requirements.

D. All trims to be through-bolted to the lock stile case. Lever design to be the same as specified with the lock sets.

E. Exit Devices shall be the modern push rail design. All exit devices shall be mounted with sex bolts and installed with the manufactures standard screws. Exit Hardware Devices found to be installed with self-drilling and self-tapping screws shall be removed and reinstalled at the installer expenses.

F. All devices shall carry a three- (3) year warranty against manufacturing defects and workmanship.

G. Furnish roller strikes for all rim and surface vertical rod exit devices. Internal springs shall be coil compression type. Furnish security dead latching for all active latch bolts.

H. All Exit Devices shall be field modifiable as incorporate an Electric Latch Retraction Feature without the purchase of new Panic Exit Hardware.

J. Exit Devices shall be the Von Duprin “99” series as specified.

2.07 SURFACE MOUNTED DOOR CLOSERS

A. All closers for this project shall be the products of a single manufacturer for continuity of design and consideration of warranty. All door closers shall be mounted as to achieve the maximum degree of opening (trim permitting).

B. All closers to be heavy duty, surface-mounted, fully hydraulic, rack and pinion action with high strength case iron cylinder to provide control throughout the entire door opening and closing cycle.

C. Size all closers in accordance with the manufacturer's recommendations at the factory.

D. All closers to have adjustable spring power sizes 1 or 2 through 4 or 6 and non-critical regulating screw valves for closing speed, latching speed and back-check control as a standard feature unless specified otherwise.

E. Provide closer covers only if provided as a standard part of the door closer package.

F. The hardware supplier shall provide all required brackets, spacers or filler plates as required by the manufacture for a proper and functional installation as part of their base bid.

G. Supply appropriate arm assembly for each closer so that closer body and arm are mounted on non-public side of door opening and on the interior side of exterior openings, except where required otherwise in the hardware sets.

H. Provide drop plates and any additional mounting brackets required for the proper installation of the door closer shall be included in the hardware supplier's base bid.

I. Finish: Baked on Powder Coated finish shall match other hardware.

J. Provide and mount all door closers with sex bolts as provided by the manufacturer.

K. Closers shall be LCN "1250" series as specified or acceptable products manufactured by Sargent "281" series.

2.08 DOOR STOPS AND HOLDERS

A. Door stops are to be furnished for every door leaf. Every door is to have a floor, wall, or an overhead stop.

B. Place doorstops in such a position that they permit maximum door swing, but do not present a hazard of obstruction. Furnish floor strikes for floor holders of proper height to engage holders of doors.

C. Where overhead stops and holders are specified, or otherwise required for proper door operation, they are to be heavy duty and of extruded brass, bronze or stainless steel with no plastic parts as specified**.** The General Contractor shall provide wood blocking in all stud walls specified and scheduled to receive wall stops.

D. Finish: Shall match other hardware where available.

E. Acceptable Products

1. Floor and wall stops as listed in hardware sets. Equivalent products as manufactured by Ives, ABH and Trimco are acceptable.

2.09 PUSH PLATES, DOOR PULLS, AND KICKPLATES

A. All push plates, door pull, kick plates and other miscellaneous hardware as listed in hardware sets. Equivalent products as manufactured by Ives, Hager and Trimco are acceptable.

B. Kick plates to be 10 inches high and Mop plates to be 6 inches high, both by 1-½ inches or 1 inch less than door width (LDW) as specified. They are to be of 16-gauge thick base metal. For door with louvers or narrow bottom rails, kick plate height to be 1 inch less dimension shown from the bottom of the door to the bottom of the louver or glass.

C. Where required armor plates, edge guards and other protective hardware shall be supplied in sizes as scheduled in the hardware sets.

D. Finish: Same as other hardware where available.

2.10 FLUSH BOLTS AND COORDINATORS

A. Provide Flush bolts with Dust Proof Strikes as indicated in the individual hardware sets by Ives, Hager and Trimco are acceptable. Finish shall match the adjacent hardware.

2.11 THRESHOLDS AND SEALS

A. Provide materials and finishes as listed in hardware sets. Zero products have been specified to set a high level of quality, equivalent product by manufactured by National Guard Products and Pemko shall be acceptable. All thresholds must be in accordance with the requirements of the ADA and ANSI A117.1.

B. Provide thresholds with wood screws and plastic anchors. Supply all necessary anchoring devices for weather strip and sound seal.

C. Seals shall comply with requirements of UL10C. All thresholds, door bottoms and weather strip inserts shall be a silicone based product as specified in 3.02 Hardware Sets. Other materials used shall be rejected, unless originally specified.

D. Seals shall comply with the requirements of the Wood Door Manufacturer’s certification requirements.

2.12 FINISHES

A. Finishes for all hardware are as required in this specification and the hardware sets.

B. Special care is to be taken to make uniform the finish of all various manufactured items.

2.13 DOOR SILENCERS

A. Provide door silencers at all openings without gasket. Provide two- (2) each at pair of doors and three- (3) or four- (4) each for each single door (coordinate with the frame manufacturer).

2.15 PROPRIETARY PRODUCTS

A. References to specific products are used to establish quality standards of utility and performance. Unless otherwise approved provide only the specified product.

B. All other materials, not specifically described, but required for a complete and proper finish hardware installation, are to be selected by the Contractor, subject to the approval of the Architect and the Owners Representative.

C. Architect and the Owners Representative reserve the right to approve all the substitutions proposed for this specification. All requests for substitution to be made prior to bid in accordance with Division 1, General Requirements, and are to be in writing, hand delivered to the Architect. Two (2) copies of the manufacturer's brochures and a physical sample of each item in the appropriate design and finish shall accompany requests for substitution.

PART 3 - EXECUTION

3.01 INSTALLATION AND SERVICE ITEMS OF FINISH HARDWARE

A. All finish hardware shall be installed by an experienced finish hardware installer with at least ten (10) years of experience after a pre-installation meeting between the contractor, hardware Manufacturers representative, the hardware supplier, the hollow metal supplier and the wood door supplier. The finish hardware installer shall be responsible for the proper installation and function of all doors and hardware.

B. The hardware supplier's office and/or warehouse shall be located within a one hundred twenty-five (125) mile radius of the project site as to better service the general contractor and the Owners Representative during this project.

C. Check hardware against the reviewed hardware schedule upon delivery. Store the hardware in a dry and secure location to protect against loss and damage.

D. Install finish hardware in accordance with approved hardware schedule and manufacturers' printed instructions. Pre-fit hardware before finish is applied to door; remove and reinstall after finish is complete and dry. Install and adjust hardware so that parts operate smoothly, close tightly, and do not rattle.

E. Mortise and cutting to be done neatly, and evidence of cutting to be concealed in the finished work. Protect all Finish hardware from scratching or other damage.

3.02 HARDWARE SETS

SPEXTRA: 434811
HARDWARE GROUP NO. 01A
FOR USE ON MARK/DOOR #(S):
17 18

EACH TO HAVE:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR

3	EA	HINGE	5BB1 4.5 X 4.5		IVE
1	EA	PUSH PLATE	8200 8" X 16"		IVE
1	EA	PULL PLATE	8305 8" 3.5" X 15"		IVE
1	EA	SURFACE CLOSER	1250 RW/PA SLIM		LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS		IVE
1	EA	WALL STOP	WS406/407CCV		IVE
3	EA	SILENCER	SR64		IVE

HARDWARE GROUP NO. 02A

FOR USE ON MARK/DOOR #(S):
13 14 15

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		IVE
1	EA	HOSPITAL PRIVACY	AL44S SAT		SCH
1	EA	SURFACE CLOSER	1250 RW/PA SLIM		LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS		IVE
1	EA	FLOOR STOP	FS410		IVE
1	EA	COAT HOOK	582		IVE
3	EA	SILENCER	SR64		IVE

HARDWARE GROUP NO. 03A

FOR USE ON MARK/DOOR #(S):
16

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		IVE
1	EA	STOREROOM LOCK	AL80PD SAT		SCH
1	EA	WALL STOP	WS406/407CCV		IVE
3	EA	SILENCER	SR64		IVE

HARDWARE GROUP NO. 04A

FOR USE ON MARK/DOOR #(S):
10 9

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		IVE
1	EA	PANIC HARDWARE	33A-NL		VON
1	EA	RIM CYLINDER	20-022		SCH
1	EA	SURFACE CLOSER	1250 SCUSH SLIM		LCN
1	EA	RAIN DRIP	142-40"		ZER
1	EA	DOOR SWEEP	50M-36"		ZER
1	EA	THRESHOLD	65-223-36" (914MM)		ZER

WEATHER STRIP PROVIDED BY THE DOOR SUPPLIER

HARDWARE GROUP NO. 05A

FOR USE ON MARK/DOOR #(S):
11

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		IVE
1	EA	ENTRANCE LOCK	AL53PD SAT		SCH
1	EA	SURFACE CLOSER	1250 RW/PA SLIM		LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS		IVE
1	EA	WALL STOP	WS406/407CCV		IVE
3	EA	SILENCER	SR64		IVE

HARDWARE GROUP NO. 06A

FOR USE ON MARK/DOOR #(S):
12

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		IVE
1	EA	ENTRANCE LOCK	AL53PD SAT		SCH
1	EA	WALL STOP	WS406/407CCV		IVE
3	EA	SILENCER	SR64		IVE

HARDWARE GROUP NO. 07A

FOR USE ON MARK/DOOR #(S):
19

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 NRP		IVE
2	EA	MANUAL FLUSH BOLT	FB458		IVE
1	EA	DUST PROOF STRIKE	DP2		IVE
1	EA	STOREROOM LOCK	AL80PD SAT		SCH
2	EA	WALL STOP	WS406/407CCV		IVE
1	EA	STRIKE ASTRAGAL	43SP-DOOR HEIGHT (PULL SIDE MOUNTED)		ZER
2	EA	SILENCER	SR64		IVE

HARDWARE GROUP NO. 08A

FOR USE ON MARK/DOOR #(S):

20

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		IVE
1	EA	STOREROOM LOCK	AL80PD SAT		SCH
1	EA	LOCK GUARD	LG1		IVE
1	EA	OH STOP	450S		GLY
1	EA	RAIN DRIP	142-40"		ZER
1	EA	GASKETING	8303-HEAD & JAMBS		ZER
1	EA	DOOR SWEEP & DRIP	8197-DOOR WIDTH		ZER
1	EA	THRESHOLD	65-223-36" (914MM)		ZER

HARDWARE GROUP NO. 09A - EXISTING DOOR & FRAME TO REMAIN

FOR USE ON MARK/DOOR #(S):

AL-102	AL-109A	AL-109B	AL-112	AL-113A	AL-113B
AL-115A	AL-115B	AL-116	AL-122	AL-126A	AL-126B
AL-128	AL-131A	AL-131B	AL-134	AL-135	AL-136
AL-143	AL-144A	AL-144B	AL-146	AL-149	E1-116

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	ENTRANCE LOCK	AL53PD SAT		SCH
		BALANCE HARDWARE	EXISTING TO BE RE-USED		

HARDWARE GROUP NO. 10A - EXISTING DOOR & FRAME TO REMAIN

FOR USE ON MARK/DOOR #(S):

AL-105	AL-106	AL-107	AL-108	AL-110	AL-111
AL-124	AL-125	AL-127	AL-129	AL-130	AL-132
AL-140	AL-147	AL-148			

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	STOREROOM LOCK	AL80PD SAT		SCH
		BALANCE HARDWARE	EXISTING TO BE RE-USED		

HARDWARE GROUP NO. 11A

FOR USE ON MARK/DOOR #(S):

AD200-103	AD200-122A	AD200-122B	AD200-123

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	ELEC CLASSROOM LOCK	AD-200-CY-70-MTK-RHO-PD-8B		SCE
		BALANCE HARDWARE	EXISTING TO BE RE-USED		

HARDWARE GROUP NO. 12A

FOR USE ON MARK/DOOR #(S):
AD200-142 AD200-145

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	PANIC HARDWARE	99-EO-SNB		VON
1	EA	ELEC EXIT DEVICE TRIM	AD-200-993R-70-MTK-RHO-PD-8B		SCE
		BALANCE HARDWARE	EXISTING TO BE RE-USED		

GENERAL NOTES & ALTERNATE A1:

1) **MATCH THE EXISTING FINISH WHICH IS 606.**
2) **ALTERNATE #A;**
   A1) CHANGE ALL LOCKS TO THE "ND" SERIES RHODES-----ADD/DEDUCT $

END OF SECTION

SECTION 08800 – GLASS AND GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes glazing for the following products and applications:
   1. Windows.
   2. Doors.
   3. Glazed entrances.

1.2 SAFETY GLASS

A. Various glass assemblies are scheduled in Part 3 of this section. Review all glazed window and door openings scheduled or shown on the drawings and provide safety glass lites where required by the Building Code governing for the location of the project.

1.3 PERFORMANCE REQUIREMENTS Exterior Glass

A. General: Provide exterior glazing systems conforming to **Texas Windstorm Tier 1** requirements and provide Manufacturer and Engineers certification for same. **Use glass with frame and fastener system approved as required by Texas Department of Insurance for Inland 1.**

B. Submit proof of approvals with shop drawings for Structural Engineers Approval.

C. The exterior doors & windows shall be designed for the following wind pressures:
P+ (towards the surface) +43 psf
P- (away from the surface) -54 psf

D. Provide glazing systems capable of withstanding thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

E. Glass Design: Glass thicknesses indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for various size openings in nominal thicknesses indicated, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
   1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
      a. Specified Design Wind Loads: Texas Windstorm Tier 1 COASTAL – Wind pressure rating equal to +43 psf of positive pressure and -54 psf of suction pressure.
      b. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.
         1) Load Duration: 60 seconds or less.
      c. Minimum Glass Thickness for Exterior Lites: Not less than 6 mm.
      d. Thickness of Tinted and Heat-Absorbing Glass: Provide the same thickness for each tint color indicated throughout Project.

F. Thermal Movements: Provide glazing that allows for thermal movements resulting from a maximum change (range) of 120°F (67°C), 180°F (100°C) in ambient and surface temperatures, respectively, acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

G. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:
   1. For monolithic-glass lites, properties are based on units with lites ¼” (6 mm) thick.
   2. For laminated-glass lites, properties are based on products of construction indicated.
   3. For insulating-glass units, properties are based on units with lites 6 mm thick and a nominal 1/2-inch-(13-mm-) wide interspace.
      a. Clear un-tempered glass of a lesser thickness may be installed in residential windows that otherwise satisfy strength requirements for the work as specified.

4. Center-of-Glass U-Values: NFRC 100 methodology using LBL-35298 WINDOW 4.1 computer program, expressed as Btu/ sq. ft. x h x deg F(W/sq. m x K).
5. Center-of-Glass Solar Heat Gain Coefficient: NFRC 200 methodology using LBL-35298 WINDOW 4.1 computer program.
6. Solar Optical Properties: NFRC 300.

1.3A PERFORMANCE REQUIREMENTS Interior Glass

A. General – Provide interior glass per code in appropriate material to match existing interior glass with anodized Aluminum Frame to match existing.

B. All interior glass to match or exceed existing interior glass in frame to match existing frames, but in anodized aluminum frames.

C. Existing interior frames to be painted to match anodized aluminum frames.

1.4 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.
B. Samples: 12-inch-(300-mm-) square, for each type of glass product indicated, other than monolithic clear float glass.
C. Glazing Schedule: Use same designations indicated on Drawings and as scheduled in Part 3 of this section.
D. Sealant compatibility and adhesion test reports.
E. Design rating information for review and acceptance before ordering.

1.5 QUALITY ASSURANCE

A. Sealant Compatibility and Adhesion Testing: Use sealant manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
B. Fire-Rated Assemblies: Where glazing products are used in fire-rated assemblies, comply with requirements of specific assembly specified in other sections of these Specifications.
   1. Door Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
   2. Window Assemblies: Complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257.
C. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.
D. Glazing Publications: Comply with recommendations of the following, unless more stringent requirements are indicated.
   1. GANA Publications: "Glazing Manual" and "Laminated Glass Design Guide."
   2. SIGMA Publications: SIGMA TM-3000, "Vertical Glazing Guidelines."

1.6 WARRANTY

G. Special Warranty: Manufacturer's standard form, made out to Owner and signed by manufacturer, in which manufacturer agrees to furnish replacements for units that deteriorate from normal use by developing defects attributable to the manufacturing process, f.o.b. the nearest shipping point to Project site, within warranty period.
   1. Coated Glass:
      a. Defects: Peeling, cracking, and other indications of degradation of metallic coating.
      b. Warranty Period: 10 years from date of Substantial Completion.
   2. Laminated Glass:
      a. Deterioration: Edge separation, delamination that materially obstructs vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
      b. Warranty Period: Five years from date of Substantial Completion.
   3. Insulating Glass:

a. Deterioration: Failure of hermetic seal resulting in obstruction of vision by dust, moisture, or film on interior surfaces of glass.
b. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other articles including schedules where subparagraph titles below introduce lists, the following requirements apply for product selection:
1. Products: Subject to compliance with requirements, provide one of the products specified.

2.2 GLASS MATERIALS

A. Annealed Float Glass: ASTM C 1036, Type I (transparent glass, flat), Quality q3 (glazing select); class as indicated in schedules at the end of Part 3.
B. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent glass, flat); Quality q3 (glazing select); class, kind, and condition as indicated in schedules at the end of Part 3
1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed.
C. Polished Wired Glass: ASTM C 1036, Type II (patterned and wired glass, flat), Class 1 (clear), Quality q8 (glazing); Form 1 (wired, polished both sides) Mesh m2 (square), 6.4 mm thick.
D. Insulating-Glass Units: Preassembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in the Insulating-Glass Schedule at the end of Part 3.
1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in "Performance Requirements" Article. Provide Kind FT (fully tempered) where safety glass is indicated.
2. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated in the Insulating-Glass Schedule at the end of Part 3 are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
3. Sealing System: Dual seal with manufacturer’s standard primary and secondary sealants.
4. Spacer: Manufacturer's standard.
5. Corner Construction: Manufacturer's standard.
6. Overall Unit Thickness and Thickness of Each Lite: 25 and 6 mm.
7. Interspace Content: AIR

2.3 GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:
1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Colors of Exposed Sealants: As selected.
B. Elastomeric Glazing Sealants: ASTM C 920, Type S (single component), Grade NS (nonsag), Class 25, Use NT (nontraffic), M, G, A, and, as applicable to glazing substrates indicated, O.
1. Glazing Sealant for Fire-Resistive Glazing Products: Sealant used in test assembly to obtain fire-protection rating.

2.4 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
C. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85, plus or minus 5.
D. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
G. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.
H. Mirror Mastic: An adhesive setting compound, produced specifically for setting mirrored glass by spot application.

2.6 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing standard, to comply with system performance requirements.

PART 3 - EXECUTION

3.1 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
   1. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
   2. Protect glass edges from damage during handling and installation. Remove glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance from Project site and legally dispose of off Project site.
   3. Apply primers to joint surfaces where required for adhesion of sealants, as determined by sealant compatibility and adhesion testing.
   4. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
   5. Provide spacers for glass lites where the length plus width is larger than 50 inches(1270 mm) unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances.
B. Protection:
   1. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface.
   2. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter.
   3. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged, including natural causes, accidents, and vandalism, during construction period.

3.2 ROLLED GLASS

A. Rolled Clear Wire Glass WG-1
   1. Polished both sides.

2. Wire pattern: Diamond Wire
3. Safety glass as allowed by: 16 CFR 1201, Safety Standard for Architectural Glazing Materials.

3.3 MONOLITHIC FLOAT-GLASS SCHEDULE

A. Uncoated Clear Float Glass: Where glass as designated below is indicated, provide Type I (transparent glass, flat), Class 1 (clear) glass lites complying with the following:
   1. Uncoated Clear Float Glass FG-1:
      a. Heat strengthening is required to resist thermal stresses induced by differential shading of individual glass lites or resist wind loads.
   2. Uncoated Clear Fully Tempered Float Glass FG-2:
      a. Class 1 (clear) Kind FT (fully tempered).

3.4 INSULATING-GLASS SCHEDULE

A. Low-E Insulating Glass:
   1. Low-E Insulating Glass IG-1:
      a. Overall Unit Thickness and Thickness of Each Lite: 1 5/16" Over-all IG consisting of ¼" PPG Solarban 70 HT or alternate that meets or exceeds performance with ½" airspace and 9/16" Heat strengthened lami with 0.090 PVB.
      b. Interspace Content: air
      c. Indoor Lite: Float glass, Class 1 (clear), Annealed
         1) Kind HS (heat strengthened), Condition A (uncoated surfaces) where heat strengthening is required to resist thermal stresses induced by differential shading of individual glass lites or resist wind loads.
      d. Outdoor Lite: Float glass, Class 1 (clear), Annealed:
         1) Kind HS (heat strengthened), Condition A (uncoated surfaces) where heat strengthening is required to resist thermal stresses induced by differential shading of individual glass lites or resist wind loads.
      e. Low-Emissivity Coating: Sputter Coat / Soft Coat Low E on second surface.
      f. Winter U-Value: 0.28
      g. Summer U-Value: 0.31
      h. Solar Heat Gain Coefficient: 0.45
      i. Outdoor Visible Reflectance: 10

   2. Low-E Fully Tempered Insulating Glass IG-2:
      a. Construction: Provide units that comply with requirements specified for Low-E insulating-glass units designated IG-1 except for: 1) Indoor Lite: Float glass, Class 1 (clear), Kind FT (fully tempered) Condition A (uncoated surfaces).2) Outdoor Lite: Float glass, Class 1 (clear), Kind FT (fully tempered), Condition A (uncoated surfaces).

END OF SECTION

SECTION 09225 -POLYMER/FIBER MODIFIED STUCCO SYSTEM

PART 1 GENERAL

2.02 SECTION INCLUDES

A. Stucco base coat consisting of a mixture of Portland cement, sand, glass fibers, water, and proprietary ingredients.
B. Lath, weather resistive barrier, and accessories for a complete installation as indicated by the Contract Documents.

2.03 RELATED SECTIONS

A. Section 03300 - Cast-In-Place Concrete.
B. Section 04200 - Unit Masonry.
C. Section 05400 - Cold-Formed Metal Framing.
D. Section 06100 - Rough Carpentry.
E. Section 06115 - Sheathing.
F. Section 07900 - Joint Sealers.

2.04 REFERENCES

A. ASTM C 144 - Standard Specification Aggregate for Masonry Mortars.
B. ASTM C 1063 - Standard Specification for Installation of Lathing and Furring for Portland Cement-Based Plaster.
C. U.B.C. Standard No. 17-1 - Kraft Waterproof Building Paper.
D. U.B.C. Standard No. 32-1 - Asphalt Saturated Building Felt.

2.05 SUBMITTALS

A. Submit under provisions of Section 01300.
B. Product Data: Submit manufacturer's specifications, installation instructions, and product data.
C. Samples: Submit samples to demonstrate compliance with texture and color indicated.
D. Certificates: Submit installer's certificate of training.

2.06 QUALITY ASSURANCE

A. The system shall be installed by an applicator approved by C-Cure Corporation.

B. Mock-ups: Provide mock-up panel using materials specified for final work. Construct mock-up as directed, and of full thickness. Demonstrate the proposed range of color, texture, and workmanship to be expected in the completed work. Obtain Architect's acceptance of visual qualities of the sample panel.

2.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the site in sealed containers of bags fully identified with manufacturer's name, brand, type, and grade. Store materials in a dry, well ventilated space, under cover and off the ground.

2.08 PROJECT CONDITIONS

A. Maintain ambient air temperatures from 43 deg F to 120 deg F during application and curing of base coat. Provide temporary heat and protection, if necessary.
B. Do not apply to frozen surfaces or surfaces containing frost.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide products manufactured by or approved by C-Cure Corporation, 16225 Park Ten Place, Suite 850, Houston, TX 77084-5155. Telephone 713-492-5100. FAX 713-492-5120.
   1. Substitutions will not be acceptable.

2.02 MATERIALS

A. Stucco Base Coat:
   1. "PermaCoat 920 Base Coat Concentrate (Fibered)".
   2. "Unicoat 720 Base Coat Concentrate (Fibered)".
B. Base Coat Admix: "PermaCoat 920 Admixture"; not less than 40% acrylic polymer solids.

C. Water: Clean, fresh, suitable for domestic consumption and free from such amounts of mineral and organic substances as would affect the stucco.

D. Sand: Clean and free from deleterious amounts of silt, loam, soluble salts, clay, and organic matter; complying with ASTM C 144.

E. Lath: Minimum 20 gauge, 1 inch galvanized steel wire fabric or 1.75 pound per square yard expanded metal lath fabricated from painted, copper bearing steel or zinc alloy (ASTM C 1063).
   1. Provide self furring lath over all substrates except unbacked polystyrene insulation board. Self furring lath shall have sufficient clearance between the wire and substrate to allow embedment in the base coat.
F. Weather Resistive Barrier:
   1. Minimum grade D Kraft Building Paper complying with U.B.C. Standard No. 17-1.
   2. Asphalt saturated rag felt complying with U.B.C. Standard No. 32-1.

G. Accessories: Coordinate depth of accessories with thickness and number of coats required. Fabricate from galvanized metal, zinc alloy, or plastic (ASTM C 1063).
   1. Corner Reinforcement: Pre-formed corners with expanded flanges having either small nose or radius corners, or expanded metal lath reinforcement extending minimum of 3" in either direction for large radius corners.
   2. Casing Beads: Pre-formed "J" trim for stucco terminations.
      a. Perforated for weep when installed at panel base edge.
   3. Control Joints: One piece "M" type trim with expanded flanges.
   4. Expansion Joints: Two piece, adjustable width slip joint, or pair of casing beads installed back to back to allow for movement between dissimilar substrates.
H. Insulation Board: Expanded or extruded polystyrene insulation board.
   1. Density: 1.5 pounds per cubic foot, minimum.
   2. Flame spread: Class 1.
   3. Smoke developed: 450, maximum.
   4. Recognized in a current evaluation report issued by ICBO, NES or the National Evaluation Service.
   5. Over open framing: 3/8 inch high tongues with compatible grooves for horizontal joints.

2.03 MIXES

A. Mix in accordance with manufacturer's recommendations.

PART 3 EXECUTION

2.02 EXAMINATION

A. Examine substrates to receive the stucco. Provide written notice of conditions detrimental to the proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.
B. Concrete and Masonry: Free from dirt from oils and curing compounds or any other materials deleterious to bonding.

2.02 WEATHER RESISTANT BARRIER

A. Installation:
   1. Install barrier over all substrates other than concrete or masonry.
   2. Install barrier under polystyrene board.

3. Over wood based sheathing install two layers of building paper, shingle fashion.
4. Over non-wood sheathings, install one layer of rag felt or building paper, weatherboard fashion; lap edges not less than 2 inches and ends not less than 6 inches.

2.02 INSULATION BOARD

A. Beginning at bottom, place insulation board horizontally with tongue faced upward and temporarily fasten with galvanized staples, roofing nails. or screws.
B. Stagger vertical butt joints at least 1 stud space from adjacent courses.
C. Locate vertical butt joints directly over studs.

2.03 BATH AND ACCESSORIES

A. Installation:
   1. Install lath beginning at bottom of wall and apply with long dimension across supports.
   2. Lap sides and ends a minimum of 1-1/2 inches.
   3. Make end laps of lath only over supports and stagger end laps in adjacent courses.
   4. Bend lath around all corners, both internal and external, or provide additional reinforcing lath.
B. Fastening:
   1. Fasten lath through sheathing and into wood studs using No. 11 gauge galvanized roofing nails or No. 16 gauge galvanized staples spaced not more than 6 inches on center with not less than 1 inch penetration.
   2. Fasten to metal studs using No. 7, Type S wafer head screws spaced not more than 6 inches on center. Screws shall penetrate at least 1/4 inch into the stud.
C. Accessories:
   1. Install corner beads or corner reinforcement at all external corners.
   2. Install casing beads where stucco stops and at all stucco terminations.
   3. Install weep screed at base.
   4. Install control joints corners of doors, windows, or any wall openings and in the stucco field to create panels no larger than 144 square feet. Distance between control joints shall not exceed 12 feet in any direction.
   5. Install expansion joints where dissimilar substrates meet and at structural expansion joints.
   6. Where control joints are not indicated at corners of doors and windows and other openings, install 12" x 12" layer of reinforcing metal lath at corners.
D. Miscellaneous: For large radius parapet caps, install additional layer of reinforcing metal lath at all parapet caps extending down minimum 3 inches either side.

2.04 STUCCO APPLICATION

A. Base Coat: Apply by hand trowel or machine spray to a minimum thickness of 3/8". Bring surface to a true and even plane using rod or darby as required for desired finish. Float surface to remove any irregularities and leave ready to receive finish coat.
B. Finish Coat: Finish coat may be applied as soon as base coat has sufficiently set. The thickness of the finish coat shall be sufficient to achieve the texture specified. When applying the finish, plan work so that the entire wall can be completed at one time so as to eliminate joining lines. If not practical, use a corner, door or window as a breaking point.
C. Texture of finish coat shall be Light Monterrey on Building "A" and Sand Finish on Building "B" or as noted on drawings.

2.02 ADJUSTING, CLEANING, AND PROTECTION

A. Upon completion, point-up stucco around trim and other locations where stucco meets dissimilar materials.
B. Cut out and patch damaged stucco.
C. Match patch of damaged stucco to existing work in form, texture and color.
D. Do not allow debris to accumulate on site.
E. Protect adjacent work from spills and stains. Immediately remove and clean base or finish coat materials from surfaces not scheduled to receive stucco.

END OF SECTION

Section 09250 - Dens-Glass Gold Architectural Specifications

Part 1 – General

1.0 Description

A. Work in this section includes, but is not limited to: Wall, ceiling and soffit sheathing.
B. Related work specified elsewhere:
   1. Brick masonry.
   2. Roof Deck
   3. Cold-formed metal framing.
   4. Rough carpentry.
   5. Finish carpentry.
   6. Exterior Insulation Finish and Systems (EIFS).
   7. Siding.
   8. Joint sealers.
   9. Light-gauge metal framing.
   10. Painting.

1.1 Submittals

A. Product Data: Submit manufacturer's descriptive literature indicating material composition, thickness, sizes and fire resistance.
B. Certificates: Submit manufacturer's written certification that product meets specified requirements.

1.2 Quality Assurance

A. Fire-resistance ratings: Where applicable, provide materials and construction that are identical to those of assemblies whose fire-resistance ratings are indicated.

1.3 Delivery, Storage and Handling

A. Delivery: Deliver materials to the job site in manufacturer's original packaging, containers and bundles with manufacturer's brand name and identification intact and legible.
B. Storage and handling: Store level and handle materials to protect against contact with damp and wet surfaces, exposure to weather, breakage and damage to edges. Provide air circulation under covering and around stacks of materials.

1.4 Limitations

A. Do not use Dens-Glass Gold sheathing as a base for nailing or mechanical fastening. Fasteners should be flush to the face of the board, not countersunk.
B. The use of forced air heaters creates volumes of water vapor which, when not properly vented, can condense on building materials. The use of these type heaters and any resulting damage is not the responsibility of G-P Gypsum. Consult heater manufacturer for proper use and ventilation. Avoid any condition that will create moisture in the air and condensation on the exterior walls during periods when the exterior temperature is lower than the interior.
C. When Dens-Glass Gold panels are used in slanted wall applications, that portion of the wall must be temporarily protected from the elements by the use of a weather barrier such as #15 felt prior to application of the cladding. Also, exposed wall ends such as may be found in parapets must be covered to prevent water from infiltrating the cavity.
D. G-P Gypsum does not warrant and is not responsible or liable for the performance of the cladding or exterior systems applied over Dens-Glass Gold sheathing. The suitability and compatibility of any system is the responsibility of the system manufacturer or design authority.
E. Do not laminate Dens-Glass Gold sheathing to masonry surfaces; use furring strips or framing spaced at manufacturer's specifications.
F. Dens-Glass Gold sheathing is not intended for roof applications. For roof applications consult our Dens-Deck® roof board brochure.
G. Dens-Glass Gold sheathing is not intended for tile applications. For tile applications, consult our Dens-Shield® Tile Backer brochure.

H. Dens-Glass Gold sheathing is not a structural product and should not be used in lieu of plywood where required.
I. Do not apply Dens-Glass Gold sheathing below grade.
J. For all installations, design details such as fasteners, sealants and control joints per system specifications must be properly installed per system specifications. Openings and penetrations must be properly flashed and sealed. Failure to do so will void the warranty.
K. Dens-Glass Gold sheathing is exceptionally resistant to weather, but it is not intended for immersion in water or sustained exposure to water and moisture. Cascading roof/floor water should be directed away from the sheathing until appropriate drainage is installed.

1.5 Warranty
A. Materials Warranty: Provide sheathing manufacturer's standard warranty covering sheathing materials for five years commencing on date of purchase.
B. Weathering Warranty: Provide sheathing manufacturer's standard warranty covering in-place exposure damage to sheathing for six months commencing on date of purchase by contractor.

Part 2—Products

2.1 Sheathing board
A. Acceptable Products:
1. L" Dens-Glass Gold sheathing
2. L" Dens-Glass Gold Fireguard sheathing
B. Characteristics:
1. Size:
a. Dens-Glass Gold sheathing: H" (12.7mm) (1/2") thick by 4' by 8', 9' or 10' (1.9 lb. per square foot).
b. Dens-Glass Gold Fireguard Sheathing: Nominal L" (15.9mm) (5/8") thick by 4' by 8', 9' or 10' (2.5 lb. per square foot).
2. Composition:
a. Gypsum sheathing manufactured in accordance with ASTM C 1177 with glass mats both sides and long edges, water-resistant treated core.

3. Fire resistance:
a. Noncombustible when tested in accordance with ASTM E 136.
b. H" or L" Dens-Glass Gold sheathing: Flame spread 0, smoke developed 0, when tested in accordance with ASTM E 84.
c. L" Dens-Glass Gold Fireguard: Sheathing is rated "Type X" as defined in ASTM C 36 when tested according to ASTM E 119 and can be used as a replacement to any other generic assembly utilizing a L" Type X gypsum board (see GA-600 for numeric assemblies).

Dens-Glass Gold Fireguard sheathing is UL classified, Type DGG in UL designs N501, N502, N505, U301, U302, U305, U309, U337, U411, U425, U467, U473, X508, X516.

2.2 Building paper
A. If required by local building code, No. 15, non-perforated, asphalt saturated felt complying with ASTM D 226, Type 1 or equal.

2.3 Accessories
A. Joint tape: 2" wide, 10x10 glass mesh tape.
B. Joint compound: G-P Gypsum setting-type joint compound.
C. Nails, wood framing: Hot dip, 11-gauge galvanized nails with -- head, 1H" min. length.
D. Screws, metal framing:
1. Type S-12, bugle head, self-tapping, rust-resistant, fine thread for heavy-steel gauge (12 to 22).
2. Type S, bugle head, rust-resistant sharp point, fine thread for light-gauge metal framing or furring.
E. Screws, metal or wood framing:
1. Wafer head, rust-resistant, Type S-12 drill or Hi-Lo, min. 1" length. Or Type W rust-resistant, bugle head, coarse thread, sharp point for wood.
F. Sealants, caulk and tape:

1. Dow Corning 795 or equivalent; Pecora 895 or equivalent.
2. Borden HPPG Elmers Siliconized Acrylic Latex Caulk or equivalent; Pecora AC-20 acrylic latex sealant; GE Silicone Silpruf Sealant; Tremco Dymonic
3. 2" wide 10 x 10 glass mesh Quick Tape or equivalent

Part 3—Execution

3.1 Preparation

Examine subframing; verify that surface of framing and furring members to receive sheathing does not vary more than G" from the place of faces of adjacent members.

3.2 Sheathing

A. Provide Dens-Glass Gold sheathing where indicated on drawings. Install sheathing in accordance with manufacturer's instructions and applicable instructions in GA-253 and ASTM C 1280.
B. Install Dens-Glass Gold sheathing with gold side out.
C. Use maximum lengths possible to minimize number of joints.
D. Wood framing: Attach Dens-Glass Gold sheathing to wood framing with nails spaced 4" o.c. at perimeter for racking shear resistance; 8" o.c. at perimeter where there are framing supports and where racking shear resistance is not required; and 8" o.c. along intermediate framing in field for both conditions.
E. Metal framing: Attach Dens-Glass Gold sheathing to metal framing with screws spaced 8" o.c. at perimeter where there are framing supports; and 8" o.c. along intermediate framing in field.
F. Drive fasteners to bear tight against and flush with surface of sheathing. Do not countersink.
G. Locate fasteners minimum K" from edges and ends of sheathing panels.
H. Building paper: If required, install building paper or equal with flashing around openings.
I. Finishing:
    1. Seal fasteners using Dow Corning 795 or Borden HPPG Elmers Siliconized Acrylic Latex Caulk or equivalent.
    2. Finish joints using Dow Corning 795 or Borden HPPG Elmers Siliconized Acrylic Latex Caulk or equivalent. Reinforce with 2" wide 10 x 10 glass mesh Quick Tape or equivalent.

3.3 Ceilings and Soffits

A. Joint treatment and finish preparation:
    1. Painted ceilings and soffits
        a. Apply joint tape over joints and embed in setting-type joint compound specified.
        b. Skim coat surface with setting-type joint compound for smooth finish.
        c. Prime and paint with exterior grade, good quality paints.

Caution:
THIS PRODUCT CONTAINS CONTINUOUS FILAMENT FIBERGLASS
Fiber released during normal handling of this product can cause skin, eye and respiratory irritation. Avoid breathing dust and contact with skin and eyes. Follow these standard work practices:

- Wear long-sleeved, loose-fitting clothing, gloves and eye protection.
- Use a respirator, such as a 3M Model 9900 or equivalent.
- Wash exposed areas with soap and warm water after handling.
- Wash work clothes separately from other clothing; rinse washer thoroughly. Operations which generate high airborne fiber concentrations (over 10 fibers/cc) require additional respiratory protection.

END OF SECTION

SECTION 09260 - GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Interior gypsum wallboard.
   2. Tile backing panels.
   3. Non-load-bearing steel framing.

1.2 SUBMITTALS

A. Product Data: For each product indicated or used in the work.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For gypsum board assemblies with fire-resistance ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

B. Sound Transmission Characteristics: For gypsum board assemblies with STC ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.

2.2 STEEL FRAMING

A. Steel Framing, General: Comply with ASTM C 754 for conditions indicated.
   1. Steel Sheet Components: Metal complying with ASTM C 645 requirements.
      a. Protective Coating:
         1) Interior Applications: manufacturer's standard corrosion-resistant zinc coating.
         2) Exterior Applications: ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.

B. Suspended Ceiling and Soffit Framing:
   1. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.
   2. Hanger Attachments to Concrete:
      a. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching hanger wires and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by a qualified independent testing agency.
      b. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other devices for attaching hangers of type indicated, and capable of sustaining, weight of involved assemblies without failure. Pullout will be remedied by installing additional anchors as required above/below the failed anchor.
         1) Select and size anchor types and powder loads per manufacturers written specifications and install per the same controls.

3. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch (4.12-mm) diameter.
4. Carrying Channels: Cold-rolled, commercial-steel sheet with a base metal thickness of 0.0538 inch (1.37 mm), a minimum 1/2-inch- (12.7-mm-) wide flange, and in depth indicated.
5. Furring Channels (Furring Members):
   a. Cold Rolled Channels: 0.0538-inch (1.37-mm) bare steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flange, 3/4 inch (19.1 mm) deep.
   b. Steel Studs: ASTM C 645, in depth indicated.
      1) Minimum Base Metal Thickness: 0.0179 inch (0.45 mm) as a minimum, but of increased gauge thickness per manufacturers recommendations for long spans or heights encountered.
   c. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22.2 mm) deep.
      1) Minimum Base Metal Thickness: 0.0179 inch (0.45 mm).
   d. Resilient Furring Channels: 1/2-inch- (12.7-mm-) deep members designed to reduce sound transmission, and asymmetrical with single leg.

C. Partition and Soffit Framing:
1. Steel Studs and Runners: ASTM C 645, in depth indicated.
   a. Minimum Base Metal Thickness: 0.0179 inch (0.45 mm).
2. Deep-Leg Deflection Track: ASTM C 645 top runner with 2-inch-(50.8-mm-) deep flanges.
3. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
   a. Minimum Base Metal Thickness: 0.0312 inch (0.79 mm).

2.3 PANEL PRODUCTS

A. Panel Size, General: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

B. Light Abuse Resistant Gypsum Wallboard: Located first 4 ft. from floor in classrooms and 8ft from floor in Corridors only, in the thickness and fire resistance as required by plans and code.

C. Gypsum Wallboard: ASTM C 36.
1. Regular Type: In thickness indicated and with long edges tapered.
2. Type X: In thickness indicated and with long edges tapered.

D. Tile Backing Panels and walls adjoining water sources:
1. Dens-Shield and Dens-Armor Board (see section 09250): to meet or exceed ASTM C 630/C 630M, with core type and in thickness indicated.

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.
1. Cornerbead: Use at outside corners.
2. Bullnose Bead: Use where indicated.
3. L-trim: Use at exposed panel edges.
   a. Use of J-trim or J-bead is strictly prohibited.
4. Expansion (Control) Joint: Use where indicated.

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475.

B. Joint Tape:
1. Interior Gypsum Wallboard: Paper.
2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
3. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, flanges of trim accessories, and fasteners, use setting-type taping compound.
      a. Use setting-type compound for installing paper-faced metal trim accessories.
   3. Fill Coat: For second coat, use setting-type, sandable topping compound.
   4. Finish Coat: For third coat, use setting-type, sandable topping compound.

D. Joint Compound for Tile Backing Panels:
   1. Glass-Mat Gypsum Sheathing Backing Board: Use setting-type taping and setting-type, sandable topping compounds.
   2. Cementitious Backer Units: As recommended by manufacturer.

2.6 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Acoustical Sealant for Exposed and Concealed Joints: Nonsag, paintable, nonstaining, latex sealant complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
   1. Products:
      a. Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.
      b. United States Gypsum Co.: SHEETROCK Acoustical Sealant.
      c. National Gypsum
      d. Dens-Shield & Dens-Armor

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
   1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
   2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Isolation Strip at Exterior Walls:
   1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

E. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
   1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

PART 3 - EXECUTION

3.1 NON-LOAD-BEARING STEEL FRAMING INSTALLATION

A. General: Comply with ASTM C 754, and ASTM C 840 requirements that apply to framing installation.

B. Suspended Ceiling and Soffit Framing:
   1. Suspend ceiling hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
3. Attach hangers to structural members. Do not support ceilings from or attach hangers to permanent metal forms, steel deck tabs, steel roof decks, ducts, pipes, or conduit.
4. Screw furring to wood framing.
5. Wire-tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.
6. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

C. Partition and Soffit Framing:
1. Where studs are installed directly against exterior walls, install isolation strip between studs and wall.
2. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
3. Frame door openings to comply with GA-600 and with gypsum board manufacturer's applicable written recommendations, unless otherwise indicated. Screw vertical studs at jambs to jamb anchor clips on doorframes; install runner track section (for cripple studs) at head and secure to jamb studs.
   a. Install two studs at each jamb, unless otherwise indicated.
   b. Extend jamb studs through suspended ceilings and attach to underside of floor or roof structure above.

4. Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

D. Z-Furring Members: Erect insulation vertically and hold in place with Z-furring members.
1. Until gypsum board is installed, hold insulation in place with 10-inch (250-mm) staples fabricated from 0.0625-inch-(1.59-mm-) diameter, tie wire and inserted through slot in web of member.

E. Polyethylene Vapor Retarder: Install to comply with requirements specified in Division 7 Section "Building Insulation."

3.2 PANEL PRODUCT INSTALLATION

A. Gypsum Board: Comply with ASTM C 840 and GA-216.
1. Space screws a maximum of 12 inches (304.8 mm) o.c. for vertical applications.
2. Space fasteners in panels that are tile substrates a maximum of 8 inches (203.2 mm) o.c.
3. On ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
4. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
   a. Stagger abutting end joints not less than one framing member in alternate courses of board.
   b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
5. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
6. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.
7. Multilayer Fastening Methods: Fasten base layers with screws; fasten face layers with adhesive and supplementary fasteners.

8. Laminating to Substrate: Comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

B. Tile Backing Panels:
   1. Glass-Mat, Water-Resistant Backing Panel: Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.
   2. Cementitious Backer Unit Application: ANSI A108.11.

3.3 FINISHING

A. Installing Trim Accessories: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturers written instructions.

B. Finishing Gypsum Board Panels: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration.
   1. Prefill open joints, rounded or beveled edges, and damaged surface areas.
   2. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape. NOTE: Use of J-bead or J-trim is strictly prohibited.
   3. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.
   4. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.

C. Cementitious Backer Units: Finish according to manufacturer's written instructions.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:
   1. Level 1: Embed tape at joints in ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.
   2. Level 2: Embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges where panels are substrate for tile and where indicated.
   3. Level 3: Embed tape and apply separate first and fill coats of joint compound to tape, fasteners, and trim flanges for surfaces receiving medium- or heavy-textured finishes or heavy wallcoverings.
   4. Level 4: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges at panel surfaces that will be exposed to view, unless otherwise indicated.

END OF SECTION

SECTION 09305 - DENS-SHIELD®

Part 1—General

1.0 Description- Dens-Shield and Dens-Armor addressed as same in specification, installation differences noted on plans

A. Work in this section includes, but is not limited to:
   1. Backer board for ceramic tile and untiled installation on walls and ceilings.
   2. Underlayment for ceramic tile installation on indoor floors.
   3. Substrate for ceramic tile installation on countertops.
B. Related work specified elsewhere:
   1. Rough carpentry.
   2. Finish carpentry.
   3. Ceramic tile.
   4. Tile adhesive.
   5. Grout.
   6. Painting.

1.1 Submittals

A. Product data: Submit manufacturer's descriptive literature indicating material composition, thickness, sizes and fire resistance.
B. Certificates: Submit manufacturer's written certification that product meets specified requirements.

1.2 Quality assurance

A. Fire resistance ratings: Where indicated, provide materials and construction which are identical to those of assemblies tested.
B. Certification: Certify that material meets specified requirements and fire resistance ratings indicated.

1.3 Delivery, Storage and Handling

A. Delivery: Deliver materials to the job site in manufacturer's original packaging, containers and bundles with manufacturer's brand name and identification intact and legible.
B. Storage and handling: Store and handle materials to protect against contact with damp and wet surfaces, exposure to weather, breakage and damage to edges. Provide air circulation under covering and around stacks of materials.

1.4 Limitations

A. Apply tile only to gray side of Dens-Shield panels.
B. Do not use Dens-Shield where there is prolonged exposure to temperatures exceeding 125°F.
C. Do not use Dens-Shield where there is continuous exposure to extreme conditions, e.g., saunas, commercial steam rooms and radiant barriers at fireplaces.
D. Do not install vapor retarders directly behind Dens-Shield panels.
E. Do not use Dens-Shield in conjunction with passive solar heat systems.
F. Do not use Dens-Shield panels as a base for nailing and mechanical fastening.
G. Do not use Dens-Shield in floor tile installation using tile having less than 2" x 2" face dimensions.
H. Do not use Dens-Shield in wall or ceiling tile applications with tile larger than K" x 14" x 14". Larger tiles can be used on walls when the weight of these tiles is carried by the floor, i.e. when the tiles begin at floor level.
I. Do not apply Dens-Shield directly to concrete or masonry block. Framing or furring of wall is necessary.
J. Not for exterior use.
K. Do not use in shower seats.
L. Do not use Type I organic mastics for floor applications. Dens-Shield should not be used as a backer for resilient flooring.
M. Do not place Dens-Shield into shower pan mortar bed. Leave minimum J" gap and fill with 100% silicone caulk.
N. Do not use wallboard joint compound or paper tape in wet areas.
O. Do not install Dens-Shield in the shower pan or use it as a shower base.

Part 2—Products

2.1 Tile backer

A. Acceptable products:
   1. Georgia-Pacific Corporation, G" or H" Dens-Shield.
   2. Georgia-Pacific Corporation, L" Dens-Shield Fireguard Type X.
B. Characteristics:
   1. Size:
      a. G" Dens-Shield: G - 5/8” thick by 4' x 4'.
      b. H" Dens-Shield: H - 5/8” thick by 32" x 5', 4' x 5' and 4' x 8'.
      c. L" Dens-Shield Fireguard Type X: L - 5/8" thick by 32" x 5' and 4' x 8'.
   2. Composition: Water-resistant treated core with glass mat moisture protectant coating and embedded glass mats, both sides. The face side is surfaced with heat-cured copolymer water- and vapor-retardant coating.
   3. Fire resistance, L" Dens-Shield Fireguard Type X: Type X when tested in accordance with ASTM E 119, UL classified.
C. Standards: ASTM C1178

2.2 Accessories

A. Trim: Sheet steel zinc-coated by hot-dip process.
B. Wood framing fasteners: Nails: 11-gauge galvanized nails with ‡/¡§" head, hot dipped. Screws: Type W or Type S, Hi-Lo, bugle head, rust resistant.
C. Metal framing fasteners: Screws: Light-gauge metal framing – Type S, bugle or wafer head, self-tapping, rust resistant. Heavy-gauge metal framing – Type S-12, bugle or wafer head, rust resistant.

2.3 Joint treatment materials

A. Joint tape:
   1. 2" wide 10 x 10 glass mesh tape.
   2. Reinforcing fabric: Balanced, alkali-resistant, open-weave, glass fiber fabric, made from continuous multi-end strands with tensile strength of not less than 120 lbs. to 140 lbs. in warp and fill directions, respectively, per ASTM D 1682 complying with ASTM D 578, and of 4.30 oz./sq. yd. minimum weight.
B. Setting-type joint compound: Untiled, non-wet areas: Georgia-Pacific setting compounds.
C. Tile setting material: Mastic or mortars, organic adhesive ANSI A136.1, dry set ANSI A118.1, latex portland cement mortar ANSI A118.4, ANSI A118.4 only for floors specified.

2.4 High-humidity and wet-area untiled finish system materials

A. Acceptable manufacturers:
   Dryvit Systems: Genesis® or comparable.
   Sto Industries: Flexyl® or comparable.
   Parex: ParFlex® or comparable.
   Synergy: Xtra-Stop® or comparable.
B. Ground coat: Job-mixed formulation of portland cement complying with ASTM C 150, Type I, white or natural color, and system manufacturer’s standard polymer-based adhesive designed for use indicated.
C. Primer: System manufacturer’s standard primer.
D. Finish coat for high-humidity areas: System manufacturer’s standard mixture, factory-mixed formulation of polymer emulsion admixture, colorfast mineral pigments, sound stone particles and fillers.
E. Finish coat for wet areas: Water-reducible epoxy coating system specified for wet areas.

Part 3—Execution

3.0 General

A. Provide Dens-Shield where indicated on drawings using fastening systems specified.
B. Use maximum lengths possible to minimize number of joints. Locate edge joints parallel to and on framing. Stagger intermediate end joints of adjacent lengths of Dens-Shield. Attach Dens-Shield panels to framing with fasteners recommended by tile backer manufacturer, spaced 6" o.c. Butt ends and edges.
C. Locate control and expansion joints at same locations as substrate and where required by finishes. Expansion joints for tile and non-tile applications: Walls – Expansion joints not to exceed every 30 lineal feet of continuous wall or as specified by designing authority. Ceilings – Not to exceed every 30 feet of continuous ceiling surface without perimeter relief or a maximum of 900 sq. ft., not to exceed every 50 feet of continuous ceiling surface with perimeter relief or a maximum of 2,500 sq. ft., or as specified by designing authority.

3.1 Tile backer

A. Wall and ceiling installations:
   1. At walls, install Dens-Shield panels vertically or horizontally.
   2. At ceilings, install Dens-Shield either parallel or perpendicular to framing as defined by building code.
   3. Install tile backer in accordance with manufacturer's recommendations and TCA Handbook for Ceramic Tile Installation, Method W245.
B. Residential and light commercial floors: Install Dens-Shield panels in accordance with manufacturer's recommendations as applicable in TCA Handbook for Ceramic Tile Installation, Method F146.
C. Countertops: Install Dens-Shield in accordance with manufacturer's recommendations and TCA Handbook for Ceramic Tile Installation, Method C513.
D. Bathtubs: Install Dens-Shield in accordance with manufacturer's recommendations and TCA Handbook for Ceramic Tile Installation, Methods W245 and B419.
E. Showers: Install Dens-Shield in accordance with manufacturer's recommendations and TCA Handbook for Ceramic Tile Installation, Methods W245 and B420 for thin-set installation and mastic installation.
F. Ceiling: Install Dens-Shield in accordance with manufacturer's recommendations and TCA Handbook for Ceramic Tile Installation, Methods W245 and C331.
G. Finishing:
   1. Substrate for tile: Apply glass mesh joint tape over joints. Embed tape in setting material indicated for specified tile finishes. Allow joints to dry prior to installing tile systems.
   2. Substrate for paint and wall coverings, dry areas (untiled): Apply glass mesh joint tape over joints. Embed tape in setting-type joint compound specified. Apply skim coat of setting-type joint compound over surface of tile backer for smooth finish.
   3. Substrate for high-humidity finish systems (untiled): Apply 6"-wide reinforcing fabric over joints. Embed fabric in ground coat. Skim-coat tile backer surface with ground coat for smooth finish. Apply in accordance with finish coat manufacturer's instructions.
   4. Substrate for wet area, water reducible epoxy coating finish (untiled): Apply 6"-wide reinforcing fabric over joints. Embed fabric in ground coat. Skim-coat with ground coat and compatible primer. Apply epoxy coatings specified as finishing step with epoxy coating system specified.

3.2 Accessories

Install accessories where indicated and in accordance with tile backer manufacturer's instructions.

END OF SECTION

SECTION 09310 - CERAMIC TILE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Porcelain floor tile.
   2. Glazed wall tile.

1.2 SUBMITTALS

A. Product Data: For each product indicated.
B. Samples:
   1. Each type, composition, color, and finish of tile.
   2. Assembled samples with grouted joints for each type, composition, color, and finish of tile.
   3. Stone thresholds in 6-inch(150-mm) lengths, maximum ¼" higher than floor finishes on either side of door after installation.

1.3 QUALITY ASSURANCE

1.4 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. Tile and Trim Units: Furnish quantity of full-size units equal to 1 percent of amount installed, for each type, composition, color, pattern, and size indicated, but not less then one full carton of each floor and wall tile.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
   1. Basis-of-Design Product: The design for each tile type is based on the product named. Subject to compliance with requirements and acceptance by the Contractor, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 TILE PRODUCTS

A. Manufacturers:
   1. Ceramiche Atlas Concorde (Atlas).
   2. Crossville Ceramics Company, L.P.
   3. Daltile; Div. of Dal-Tile International Inc.
   4. Florida Tile Industries, Inc.
   5. Metropolitan Ceramics.
   6. Seneca Tiles, Inc.
   7. Summitville Tiles, Inc.
   8. United States Ceramic Tile Company.
   9. Walker Zanger (slate tile).
   10. Tile Cera
B. Unglazed Paver Tile: Flat tile as follows:
   1. Composition: Porcelain .
   2. Facial Dimensions: 11-13/16 by 11-13/16 inches(300 by 300 mm).
   3. Thickness: 5/16" inch.
   4. Face: Pattern of design indicated, with cushion edges.

5. For latex-portland cement-mortared and -grouted paver tile, precoat with temporary protective coating.

C. Glazed Wall Tile: Flat tile as follows:
   1. Module Size: 4-1/4 by 4-1/4 inches(108 by 108 mm).
   2. Thickness: 5/16 inch(8 mm).
   3. Face: Plain with cushion edges.
   4. Finish: Mat, opaque glaze.
   5. Mounting: Factory back-mounted.

D. Glazed Wall Tile Trim Units: Matching characteristics of adjoining flat tile and coordinated with sizes and coursing where applicable.
   1. Base: Coved, module size 4-1/4 by 4-1/4 inches(108 by 108 mm).
   2. Wainscot Cap: Bullnose, module size 4-1/4 by 4-1/4 inches(108 by 108 mm).
   3. External Corners: Bullnose.
   4. Internal Corners: Field-butted square corners except with coved base and cap angle pieces designed to fit with stretcher shapes.

E. ANSI Ceramic Tile Standard: Provide Standard grade tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.
   1. A full compliment of base cove, base cap, wainscot cap, internal and external corners and bullnose ends is required whether shown on the drawings or not.
   2. A full compliment of base cove, base cap, wainscot cap, internal and external corners and bullnose ends is required whether shown on the drawings or not.

2.3 SETTING AND GROUTING MATERIALS

A. Manufacturers:
   1. Atlas Minerals & Chemicals, Inc.
   2. Bostik.
   3. LATICRETE International Inc.
   4. MAPEI Corporation.
   5. Southern Grouts & Mortars, Inc.
   6. Summitville Tiles, Inc.

B. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.
   1. Prepackaged dry-mortar mix combined with liquid-latex additive.
   2. For wall applications, provide nonsagging mortar.

2.4 MISCELLANEOUS MATERIALS

A. Elastomeric Sealants: Elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements in Division 7 Section "Joint Sealants."
   1. One-Part, Mildew-Resistant Silicone: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for in-service exposures of high humidity and extreme temperatures.
      a. Products:
         1) Dow Corning Corporation; Dow Corning 786.
         2) GE Silicones; Sanitary 1700.
         3) Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
         4) Tremco, Inc.; Tremsil 600 White.
   2. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.
      a. Products:
         1) Bostik; Chem-Calk 550.
         2) Mameco International, Inc.; Vulkem 245.
         3) Pecora Corporation; NR-200 Urexpan.
         4) Tremco, Inc.; THC-900.

B. Cementitious Backer Units: ANSI A118.9 in maximum lengths available to minimize end-to-end butt joints.

1. Thickness: As indicated.
2. Products:
   a. C-Cure; C-Cure Board 990.
   b. Custom Building Products; Wonderboard.
   c. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
   d. Georgia Pacific, Dens-Shield Tile Backer.
   e. James Hardy, Hardibacker Ceramic Tile Backerboard.
   f. USG Corporation; DUROCK Cement Board.

C. Trowelable Underlayments and Patching Compounds:
   1. Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials.

D. Metal Edge Strips:
   1. Angle or L-shape, white zinc alloy or stainless steel; ASTM A 666, 300 Series exposed-edge material.

E. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints that does not change color or appearance of grout.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.

B. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions.

C. Remove protrusions, bumps, and ridges by sanding or grinding.

D. Blending: For tile exhibiting color variations, use factory blended tile or blend tiles at Project site before installing. Installed clouds will be removed and replaced with blended materials.

E. Field-Applied Temporary Protective Coating: Where indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.2 INSTALLATION, GENERAL

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.

B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.

C. 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.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Grind cut edges of tile abutting trim, finish, or built-in items. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area unless drawings indicate a pattern start point. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.

F. Expansion Joints: Locate expansion joints and other sealant-filled joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
   1. Locate joints in tile surfaces directly above joints in concrete substrates.
   2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

G. Grout tile to comply with requirements of ANSI A108.10, unless otherwise indicated.
   1. For chemical-resistant epoxy grouts, comply with ANSI A108.6.

H. Install waterproofing to comply with ANSI A108.13 and waterproofing manufacturer's written instructions to produce waterproof membrane of uniform thickness bonded securely to substrate.
   1. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

I. For installations indicated below, follow procedures in ANSI A108 Series tile installation standards for providing 95 percent mortar coverage.
   1. Tile floors in wet areas.
   2. Tile swimming pool decks.
   3. Tile floors composed of tiles 8 by 8 inches (200 by 200 mm) or larger.
   4. Tile floors composed of rib-backed tiles.

J. Install tile on floors with the following joint widths:
   1. Ceramic Mosaic Tile: 1/16 inch (1.6 mm).
   2. Quarry Tile: 1/4 inch (6.35 mm).

K. Install tile on walls with the following joint widths:
   1. Ceramic Mosaic Tile: 1/16 inch (1.6 mm).
   2. Glazed Wall Tile: 1/16 inch (1.6 mm).
   3. Quarry Tile: 1/4 inch (6.35 mm).

L. Apply grout sealer to grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer that has gotten on tile faces by wiping with soft cloth.

3.3 FLOOR TILE INSTALLATION SCHEDULE

A. Include 20% for pattern installation

B. Exterior floor installation on concrete, cement mortar bed (thickset) bonded to concrete; TCA F101.
   1. Bond Coat/Thin-Set Mortar: Latex- Portland cements mortar.
   2. Grout: Sand-portland cements Polymer-modified sanded grout.

C. Interior floor installation on concrete or lightweight floor fill; thin-set mortar; TCA F113.
   1. Thin-Set Mortar: Latex- Portland cement mortar.
   2. Grout: Polymer-modified sanded grout.

3.4 WALL TILE INSTALLATION SCHEDULE

A. Include 20% for pattern installation

B. Exterior and interior wall installation over masonry or concrete; thin-set mortar, TCA W202.
   1. Thin-Set Mortar: Latex- Portland cements mortar.
   2. Grout: Polymer-modified sanded grout.

C. Interior wall installation over solid backing, organic adhesive; TCA W223.
   1. Grout: Polymer-modified sanded grout.

D. Interior wall installation over gypsum board on metal studs; organic adhesive; TCA W242.
   1. Grout: Polymer-modified unsanded grout.

E. Interior wall installation; thin-set mortar; over gypsum board; TCA W243 or cementitious backer units; TCA W244.
   1. Thin-Set Mortar: Latex- portland cement mortar.
   2. Grout: Polymer-modified sanded grout.

F. Interior wall installation over glass-mat, water-resistant backer board; thin-set mortar; TCA W245.
   1. Thin-Set Mortar: Latex- portland cement mortar.
   2. Grout: Polymer-modified sanded grout.

END OF SECTION

SECTION 09511 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes acoustical panels and exposed suspension systems for ceilings.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Samples: For each acoustical panel, for each exposed suspension system member, for each exposed molding and trim, and for each color and texture required.

1.3 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. Acoustical Ceiling Units: Full-size units equal to 2.0 percent of quantity installed, but not fewer than full, unbroken cartons in excess of the percentage quantity stated.
   2. Suspension System Components: Quantity of each exposed component equal to 1.0 percent of quantity installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
   1. Basis-of-Design products are included in the following articles. The Contractor will entertain similar products by the manufacturers listed in the following articles, but the Owner/Contractor reserves the right to require installation of the Basis-of-Design product.

B. Manufacturers:
   1. Armstrong World Industries, Inc.
   2. Celotex
   3. USG Interiors
   4. Hunter-Douglas

2.2 GENERAL

A. Acoustical Panel 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.
   1. Anchors in Concrete: Expansion anchors fabricated from corrosion-resistant materials, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
   2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times

that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

D. Wire Hangers, Braces, and Ties: Zinc-coated carbon-steel wire; ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
   1. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch-(2.69-mm) diameter wire.

E. Seismic struts and seismic clips.

F. Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

2.3 ACOUSTIC PANELS

A. Products:

   1. Single Application, “Public area”- Lobby : Armstrong “Cirrus” fine texture, tegular, Item No.549 - **ACT-1**.
      a. Type and Form: Type III, mineral base with color through; Form 1, cast or molded,.
      b. Color: As selected from manufacturer's standard pastel (off-white) range.
      c. NRC: Not less than .65-.75, Type E-400 mounting per ASTM E 795.
      d. Edge Detail: Reveal sized to fit flange of exposed suspension system members.
      e. Thickness: 3/4 inch(19 mm).
      f. Size: 24 by 24 inches(610 by 610 mm).

   2. General Applications: All Areas except Restrooms: Armstrong “Clean Room VL” non-perforated, square lay-in, Item No. 870 - **ACT-2** .
      a. Type and Form: Type III, mineral base with painted finish; Form 2, water felted.
      b. Color: White
      c. LR: Not less than 0.85.
      d. NRC: Not less than 0.50,Type E-400 mounting per ASTM E 795.
      e. Thickness: 5/8 inch (15 mm).
      f. Size: 24 by 48 inches (610 by 1220 mm).
      g. High Moisture Resistant

2.4 METAL SUSPENSION SYSTEM

A. Products:
   1. Donn DX
   2. Use: Lay-in and tegular applications.
   3. Structural Classification: Intermediate -duty system.
   4. End Condition of Cross Runners: Override (stepped) type.
   5. Cap Material: Steel cold-rolled sheet.
   6. Cap Finish: Painted in color as selected from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders. Inform Architect prior to proceeding with the work if specific patterns shown on the plans cannot be accomplished as drawn.

C. Suspend ceiling hangers from building's structural members, plumb and free from contact with insulation or other objects within ceiling plenum. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers, use trapezes or equivalent devices.
   1. Do not support ceilings directly from permanent metal forms or floor deck; anchor into concrete slabs.
   2. Do not attach hangers to steel deck tabs or to steel roof deck.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels. Screw attach moldings to substrate with concealed fasteners at intervals not more than 16 inches(400 mm) o.c. and not more than 3 inches(75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet(3.2 mm in 3.66 m). Miter corners accurately and connect securely. Square-cut and lapped corners will be removed and replaced.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Field shape cut panel edges to match factory edge. Shadowline panels will lay on edge moldings at same level as the runners and without “mouse holes”

G. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

END OF SECTION

SECTION 09651 - RESILIENT FLOOR TILE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Vinyl composition tile (VCT).

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Samples: Full-size units of each color and pattern of resilient floor tile required.

1.3 PROJECT CONDITIONS

A. Maintain temperatures within range recommended by manufacturer, but not less than 70° F(21° C) or more than 95° F(35° C), in spaces to receive floor tile during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55° F(13° C) or more than [95° F(35° C)].

C. Close spaces to traffic during floor covering installation.

D. Close spaces to traffic for 48 hours after floor covering installation.

E. Install resilient products after other finishing operations, including painting, have been completed.

1.4 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 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

PART 2 - PRODUCTS

2.1 VINYL COMPOSITION TILE

A. Vinyl Composition Tile (VCT): ASTM F 1066.
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   2. Products: Subject to compliance with requirements, provide one of the following:
      a. AB ColorPlus, American Biltrite (Canada) Ltd.
      b. Armstrong World Industries, Inc.; Standard Excelon .
      c. Azrock Commercial Flooring, DOMCO.
      d. Congoleum Corporation.
      e. Mannington Mills, Inc.
      f. Tarkett Inc.

B. Color and Pattern: As selected from manufacturer's full range.

C. Class: 2 (through-pattern tile).

D. Wearing Surface: Smooth.

E. Thickness: 0.125 inch(3.2 mm).

F. Size: 12 by 12 inches(305 by 305 mm).

G. Fire-Test-Response Characteristics:
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm per ASTM E 648.

2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
   3. Moisture Testing:
      a. Perform 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) in 24 hours.
      b. Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

E. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
   1. Do not install resilient products until they are same temperature as space where they are to be installed.

F. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
   1. Lay tiles in pattern indicated.

B. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
   1. Lay tiles with grain direction alternating in adjacent tiles (basket-weave pattern) or in pattern of colors and sizes indicated.

C. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, doorframes, thresholds, and nosings.
   1. Furniture and equipment shown by dotted lines on the drawings are to be set on top of the tile after completion of this work.

D. Extend tiles into toe spaces, door reveals, closets, and similar openings.

E. Changes of color or pattern between rooms as indicated on the drawings or in Finish Schedule will occur at center of door when in the closed position.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

G. Install tiles on covers for telephone and electrical ducts and similar items in finished floor areas. Maintain overall continuity of color and pattern with pieces of tile installed on covers. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

H. Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

I. Perform the following operations immediately after completing resilient product installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.
      a. Do not wash surfaces until after time period recommended by manufacturer.

J. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

END OF SECTION

SECTION 09653 - RESILIENT WALL BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Wall base.
   2. Molding accessories.

1.2 SUBMITTALS

A. Product Data: For each product indicated.
B. Samples: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches(300 mm) long, of each resilient product color, texture, and pattern required.

1.3 PROJECT CONDITIONS

A. Maintain temperatures within range recommended by manufacturer, but not less than 70° F(21° C) or more than 95° F(35° C), in spaces to receive floor tile during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.
B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55° F(13° C) or more than 95° F(35° C).
C. Install resilient products after other finishing operations, including painting, have been completed.

1.4 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. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 COLORS AND PATTERNS

A. Colors and Patterns: As selected from manufacturer's full range.

2.3 RESILIENT WALL BASE -Drawing designation, B-2.

A. Wall Base: ASTM F 1861.
   1. Armstrong World Industries, Inc.
   2. Azrock Commercial Flooring, DOMCO.
   3. Burke Mercer Flooring Products.
   4. Johnsonite.
   5. Marley Flexco (USA), Inc..
   6. Roppe Corporation.
   7. VPI, LLC, Floor Products Division.
B. Type (Material Requirement): TV (vinyl).
C. Group (Manufacturing Method): I (solid, homogeneous) or II (layered).
D. Style:
   1. Hard surface floors: cove (with top-set toe).
   2. Carpeted floors: straight type.

E. Minimum Thickness: 0.125 inch (3.2 mm).
F. Height: 4 inches (102 mm).
G. Lengths: Coils in manufacturer's standard length.
H. Outside Corners: Job formed or premolded.
I. Inside Corners: Job formed.
J. Surface: Smooth.

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturers for applications indicated.
B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.
B. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
C. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.
D. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
   1. Do not install resilient products until they are the same temperature as the space where they are to be installed.
E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 RESILIENT WALL BASE INSTALLATION

A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
D. Do not stretch wall base during installation.
E. On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.
F. Premolded Corners: Install premolded corners before installing straight pieces.
G. Job-Formed Corners: (use at odd angles or curves only)
   1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
   2. Inside Corners: Use straight pieces of maximum lengths possible. Form by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

3.3 RESILIENT ACCESSORY INSTALLATION

A. 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.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing resilient product installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.
      a. Do not wash surfaces until after time period recommended by manufacturer.

B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

END OF SECTION

SECTION 09900 – PAINTING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division – 1 Specification sections, apply to work of this section.

1.2 SCOPE

A. Painting work includes surface preparation and cleaning, primer touch-up of shop primed items, repair of existing coatings (including barrier coats required to properly apply new coating systems), and field priming and painting exterior and interior material, equipment and appurtenances, including but not limited to painting the following items:
   1. All exterior ferrous metals, except as specified
   2. all exterior non-ferrous metals, except as specified
   3. All exterior concrete masonry units
   4. Exterior concrete with painted finish
   5. Exterior traffic and lane marketings
   6. All interior ferrous metals, except as specified
   7. All interior non-ferrous metals, except as specified
   8. Interior concrete masonry with painted finish
   9. Interior gypsum drywall with painted finish, includes Densglass and Densheild
   10. All prime – coated hardware and other factory primed metal items
   11. All exposed conduit, outlet boxes and electrical cabinets, excluding those located in mechanical rooms
   12. All metal grilles, except anodized aluminum, unless otherwise indicated
   13. Other items normal requiring painting or finishing, or which are indicated to be painted or finished. Refer to drawings, schedules, detail, and other specification sections for other items required to be field painted or finished
   14. Where an item is not specifically mentioned, paint the same as similar adjacent materials or surfaces.

B. Do not include painting of:
   1. Pre-finished or factory finished items (e.g., shop finished woodwork and casework, acoustic materials, and similar items).
   2. Aluminum, copper, chromium, stainless steel, and other plated finishes
   3. Concealed surface in concealed and inaccessible areas including furred areas, pipe chases, duct shafts, and similar spaces.
   4. Operating parts of mechanical, electrical and plumbing equipment, including sensing devices, motor and fan shafts, sprinkler heads.
   5. Code required labels and nomenclature plates
   6. Items indicated to receive special coatings.

C. "Paint" includes coating system materials, primers, emulsion, enamels, stain, sealer and filler, and other applied materials whether used as prime, intermediate or finish coats.

1.3 RELATED WORK OF OTHER SECTIONS

A. Coordinate work of this Section with work of other Sections as required to properly execute the Work and as necessary to maintain satisfactory progress of the work of other Sections, including:
   1. Section 09250 – Gypsum Drywall Systems; Joint preparation.
   2. Shop Priming: Unless otherwise specified, shop priming of ferrous metal items is included under various Sections for structural steel, metal fabrications, hollow metal work and similar items. Unless otherwise specified, shop priming of fabricated components such as architectural woodwork, wood casework and shop-fabricated or factory-built mechanical and electrical equipment or accessories is included under other Technical Sections.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical information, label analysis and application instructions for each material proposed for use.

B. Samples for Verification Purposes: Architect will identify colors required for surfaces to be painted. Provide samples of color and texture on representative samples of actual substrate. Define each separate coat, including fillers and primers, of each finish sample. Re-submit until required sheen, color, and texture are achieved.
   1. Concrete Masonry: On concrete masonry, provide two 4" x 8" samples of masonry with mortar joint in center for each color and finish
   2. Ferrous Metal: On actual metal substrate, provide two 4" square samples of metal r each color and finish
   3. Interior Drywall: Provide painted wall surfaces for review of proposed colors for approval.

1.5 QUALITY ASSURANCE

A. Single Source Responsibility: For each finish system, provide primers and other undercoat material produced by same manufactures as finish coats. Use only thinners approves by coating manufacturer, and use only within recommended limits.
B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of total system for various substrates. On request, finish information on characteristics of specified finish materials, to ensure use of compatible primers.
C. Field Samples: On wall surfaces and other exterior and interior components, duplicate finishes of approved samples. Provide full-coat finish samples on at least 100 sq. ft. of surface and 10 linear feet of each type of trim, as directed, until require sheen, color, and texture is obtained: simulate finished lighting conditions for review of in-place work.
   1. Final acceptance of colors will be made from job-applied samples.
   2. Architect will select areas for field sample application. Upon acceptance, field samples will be used to evaluate coating system of a similar nature.
   3. Allow for one revision of each field sample.
   4. EXCEPTION: The Interior Concrete Floor Stain requires different field samples: see description of field samples in the Product section for Interior Concrete Stain

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to protect Site in manufacturer's original, unopened containers bearing manufacturer's name, label, and following information:
   1. Product name or title of material
   2. Product description (generic classification).
   3. Fed. Spec. number, if applicable.
   4. Manufacturer's stock number and date of manufacturer
   5. Contents by volume, for pigment and vehicle constituents
   6. Thinning instructions
   7. Application instructions
   8. Color name and number
B. Store materials not in actual use in tightly-covered container. Maintain containers used in storage of paint in a clean condition, free of foreign materials and residue. Protect from freezing where necessary. Keep storage area neat and orderly. Remove oil rags and waste daily.
C. Take precautions to ensure that workmen and work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing and applications of paints.

1.7 JOB CONDITIONS

A. Apply water-base paints only when temperature of surfaces to be painted and surrounding air temperatures are between 50° F (10° C) and 90° F (32°C) unless otherwise permitted by paint manufacturer's printed instructions.
B. Apply solvent-thinned paints only when temperature of surfaces to be painted and surrounding air temperatures are between 45° F (7° C) and 95° F (35°C) unless otherwise permitted by paint manufacturer's printed instructions.
C. Do not apply paint in snow, rain, fog or mist, or when relative humidity exceeds 85%, or to damp or wet surfaces, unless otherwise permitted by paint manufacturer during application and drying periods.

1. Painting may be continued during inclement weather if areas and surfaces to be painted are enclosed and heated within temperature limits specified by paint manufacturer during application and drying periods.

1.8 WARRANTY

A. Furnish special project warranty as specified, agreeing to repair or replace painting work which becomes unserviceable or objectionable in appearance as a result of failure in materials or workmanship. Failures in materials and workmanship include, but are not limited to noticeable discoloration, yellowing, streaking, blooming, bleaching, or darkening, peeling, cracking, blistering, alligatoring, loss adhesion to substrate or to intermediate coat, excessive chalking or dusting, staying tacky or becoming tacky, or mildewing. Warranty period shall be 1 year from date of Substantial Completion.

PART 2- PRODUCTS

2.1 MANUFATURER

A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
   1. Devoe and Reynolds Company (Devoe)
   2. Benjamin Moore and Company (Moore)
   3. The O'Brien Corp. (F-O'B)
   4. PPG Industries, Pittsburgh Paints (Pittsburgh)
   5. Pratt and Lambert (P&L)
   6. The Sherwin-Williams Company(S-W)
   7. Glidden Coatings and Resins

2.2 MATERIAL QUALITY

A. Provide the manufacturer's best quality trade sale paint material of the various coating types specified. Paint material containers not displaying manufacturer's product identification will no be acceptable.
   1. Proprietary names used to designate colors or materials are not used intended to imply that manufacturers or products named are required or to exclude equivalent products of the other specified manufacturers.
   2. Federal Specifications establish a minimum quality level for paint materials, except where other product identification is used. Provide written certification from the manufacturer that materials provided meet or exceed these criteria.
   3. Use color pigments that are pure, non-fading, suitable for substrate and service indicated. Lead content in pigment, if any, is limited to contain no more than 0.06% lead, as lead metal based on the total non-volatile (dry film) of paint by weight. This limitation is extended to interior surfaces and those exterior surfaces, such as stairs, decks, porches, railings, windows and door which are readily accessible to children under 7 years of age.

2.3 EXTERIOR PAINT MATERIALS SYSTEM

A. Exterior Ferrous Metal
   1. Latex Semi-Gloss Enamel: 2 finish coats over primer
      a. Primer: Rust Inhibitive Latex Primer. Primer is not required on items delivered shop primed unless primer is incompatible with finish coats.
         i. Devoe: 41702 Metalclad Flat Primer
         ii. F-O'B: 621-05 Blox Rust Latex Metal Primer
         iii. Moore: Ironclad Retard-X Rust Inhibitive Primer 162
         iv. Pittsburg: 6-712 Water-Base Metal Primer
         v. S-W: DTM Acrylic Primer/Finish B66 W1

      b. First and Second Finish Coats: Exterior Semi-Gloss Latex Enamel
         i. Devoe: 417XX Metalclad Semi-Gloss Enamel
         ii. F-O'B: 664-XX Weather King II Latex House Paint
         iii. Moore: Impervex Enamel 309
         iv. Pittsburg: 53-6 Line Water-Base Enamel

v. S-W: Metalatex Semi-Gloss Enamel B42W110

B. Exterior Non-Ferrous Metal (Zinc-Coated Steel and Aluminum)
1. Latex Semi-Gloss Enamel: 2 finish coats over primer.
a. Primer: Latex Galvanized Metal Primer
i. Devoe: 41702 Metalclad Acrylic Primer/Finish
ii. F-O'B: 621-05 Blox Rust Latex Metal Primer
iii. Moore: Ironclad Galvanized Metal Latex Primer 155
iv. Pittsburg: 6-209 Speedhide Steel Primer
v. S-W: B50W3 Galvite Paint

b. First and Second-Finish Coats: Exterior Semi-Gloss Latex Enamel.
i. Devoe: 417XX Metalclad Semi-Gloss Enamel
ii. F-O'B: 664-XX Weather King II Latex House Paint
iii. Moore: Impervex Enamel 309
iv. Pittsburg: 53-6 Line Water-Base Enamel
v. S-W: Metalatex Semi-Gloss Enamel B42W110

C. Exterior Concrete Masonry Units (Stain)
1. Concrete Stain: 2 coats stain under 1 coat Concrete Sealer
a. Stain
i. S-W H&C Silicone Acrylic Concrete Stain
Equivalent products of other specified manufacturers
b. Sealer
i. S-W HB 100 or 120
ii. equivalent products of other specified manufactures

D. Exterior Wood (Stain)
1. 2 coats Semi-Transparent Stain
a. S-W Woodscapes Semi-Transparent
b. Equivalent products of other specified manufactures

E. Exterior Concrete Paving Traffic and Lane Marketing:
1. Alkyd Resin: 2 coats applied with a line-marketing machine at the rate 1 mils wet film thickness (100 to 150 sq.ft./gal.) per coat; white or yellow color as selected by Architect. Provide Pittsburg 11-line Traffic and Zone Marketing Paint or Devoe 442XX Traffic-Line Alkyd Traffics-Marking Paint.

2.4 INTERIOR PAINT MATERIALS SYSTEM

A. Interior Wood – Stain:
1. 1 coat varnish over 1 coat stain
a. Stain
i. S-W: Wood Classics
ii. Equivalent products of other specified manufactures
b. Varnish
i. S-W: Wood Classics Varnish
ii. Equivalent products of other specified manufacturers

B. Interior Ferrous Metal:
1. Latex Semi-Gloss Enamel: 2 finish coats over primer.
a. Primer: Rust Inhibitive Latex Primer. Primer is not required on items delivered shop primed unless primer is incompatible with finish coats.
i. Devoe: 41702 Metalclad Flat Primer
ii. F-O'B: 621-05 Blox Rust Latex Metal Primer
iii. Moore: Ironclad Retard-X Rust inhibitive Primer 162
iv. Pittsburg: 6-712 Water-Base Metal Primer
v. S-W: Metalatex Flat B42W110

b. First and Second Finish Coats: Interior Semi-Gloss Latex Enamel.

i. Devoe: 417XX Metalclad Semi-Gloss Enamel
ii. F-O'B: 214-XX Acrylic Semi-Gloss Enamel
iii. Moore: Impervex Enamel 309
iv. Pittsburg: 53-6 Line Water-Base Enamel
v. S-W: Metalatex Semi-Gloss Enamel B42W110

C. Interior Non-Ferrous Metal (Zinc-Coated Steel and Aluminum):
1. Latex Semi-Gloss Enamel: 2 finish coats over primer.
a. Primer: Latex Galvanized Metal Primer.
i. Devoe: B42W110 Industrial Water-Base Paint
ii. F-O'B: 621-04 Blox Rust Latex Metal Primer
iii. Moore: Ironclad Galvanized Metal Latex Primer 155
iv. Pittsburg: 6-209 Speedhide Steel Primer
v. S-W: B50W3 Galvite Paint

b. First and Second Finish Coats: Interior Semi-Gloss Latex Enamel
i. Devoe: 417 Metalclad Semi-Gloss Enameled Paint
ii. F-O'B: 214-XX AA Acrylic Semi-Gloss Enamel
iii. Moore: Impervex Enamel 309
iv. Pittsburg: 53-6 Line Water-Base Enamel
v. S-W: Metalatex Semi-Gloss enamel B42W1100

D. Interior Concrete Masonry Units (Except wet areas):
1. Latex Satin/ Eggshell Emulsion Finish: 2 finish coats over filled surface.
a. Filler coat: High Performance Latex Block-Filler. Apply filler coat at a rate to ensure complete coverage with pores filled.
i. Devoe: 52901 Bloxfil Acrylic Latex Block-Filler
ii. F-O'B: 280-00 Block-Filler
iii. Moore: Moorecraft Block-Filler #145
iv. Pittsburg: 6-7 Latex Masonry Block-Filler
v. P & L: Primafil block-Filler
vi. S-W: Heavy Duty Block-Filler B42W46

b. First and Second Finish coats: Latex-Based Interior Semi-gloss Latex (as F. 2 below) Paint

E. Interior Concrete Masonry Units (wet areas)
1. 2 Coats Epoxy over Epoxy Filler Sealer
a. Filller Coat: Epoxy Filler Sealer
i. S-W: Kemcaticote Epoxy Filler Sealer
ii. Equivalent products of other specified manufactures

b. First and Second Finish Coats: Latex-Based Interior Satin/Eggshell Paint
i. S-W: High Solids Catalyzed Epoxy
ii. Equivalent products of other specified manufacturers

F. Interior Gypsum Drywall Systems:
1. Satin or Eggshell Finish: 2 finish coats over primer with total dry film thickness no less than 2.5 mils
a. Primer: Texturing media an tinted latex primer – light orange peel texture per approved sample
b. First and Second Finish Coats: Latex-Based Interior Paint
2. Semi-Gloss Latex Enamel Finish: 2 finish coats over primer with total dry film thickness not less than 2.5 mils
a. Primer: Latex-Based Interior Tinted or White as required Primer (FS TT-P-650)
i. Devoe: 50801 Wonder-Tones Vinyl Latex Primer and Sealer
ii. F-O'B: 220-20 Pro-Tech Latex Wall Primer
iii. Moore: Moore's Latex Quick-Dry Prime Seal #201
iv. Pittsburgh: 6-2 PPG Quick-Dry Latex Primer Sealer

v. P & L: Vapex Wall Primer Z30001
vi. S-W: ProMar 200 Latex Wall Primer B28W200

b. First and Second Finish Coats: Latex-Based Interior Semi-Gloss Enamel (Performance Alternative for FS TT-P-1511)
i. Devoe: 38XX Wonder-Tones Interior Acrylic Latex Semi-Gloss Enamel
ii. F-O'B: 214-XX AA Acrylic Semi-Gloss Enamel
iii. Moore: Regal 333 Aqua Glow satin
iv. Pittsburgh: 32.- Interior Latex Semi-Gloss
v. P & L: Aqua Satin Latex Enamel
vi. S-W: A88 Series Super Paint Latex Semi-Gloss

G. Interior Concrete (Satin)
1. One coat stain under one coat top coat
a. Stain
i. S-W: H & C Shield Plus (Color) mixed with H & C Shield Plus Clear to achieve semi-transparent effect. Allow for up to 5 field mock-ups, 3' x 3' on cured concrete samples equivalent to, but not part of, the concrete floor. The greater-than-usual numbers of samples are required to determine the best proportion of clear to color stain to achieve the desired semi-transparent effect. Samples to be finished with top coat of H & C Shield Plus Clear
ii. Equivalent products of other specified manufacturers
b. Topcoat
i. S-W: H & C Shield Plus Clear
ii. Equivalent products of other specified manufacturers

PART 3 EXECUTION

3.4 EXAMINATION
A. Examine substrate and conditions under which painting will be compliance with requirements for application of paint. Do not begin paint application until unsatisfactory conditions have been corrected.
1. Star painting will be construed as the Applicator's acceptance of surface and conditions within a particular area.

3.5 PREPARATION
A. General Procedure: Remove hardware and hardware accessories, plates, machined, surfaces, lighting fixtures, and similar items in place that are not to be painted, or provide surface-applied protection prior or surface preparation and painting. Remove these items if necessary for complete painting of the items and adjacent surfaces. Following of paint operations in each space or area, have items reinstalled by workers skilled in the trades involved.
1. Clean surfaces before applying paint or surface treatments. Remove oil and grease prior to cleaning. Schedule cleaning and painting so that dust and other contaminates from the cleaning process will not fall on wet, newly-painted surfaces.
2. Seal water stains, ball-point ink, felt-tip marker, pencil marks and other surface contamination which may bleed through paint with white shellac or other similar sealer.
3. Mask surface not required to be panted.
4. Feather-edge sandpaper damaged, flaking, chipped and blistered areas of existing paint to provide a smooth imperceptible transition between existing and repaired paint areas. Fill imperfections and holes in finish surfaces with drywall joint compound or putty. Sandpaper smooth when dry.
B. Surface preparation: Clean and prepare surface to be painted in accordance with the manufacturer's instructions for each particular substrate condition, and as specified.
1. Provide barrier coats over incompatible primers or removed and re-prime. Notify Architect in writing of problems anticipated with using the specified finish-coat material with substrate primed by others.

2. Cementitious Materials: Prepare concrete, concrete masonry block and cement plaster surfaces to be paint. Remove efflorescence, chalk, dust, dirt, grease oils, and release agents. Roughen as required to remove glaze. If hardeners or sealer have been used to improve curing, use mechanical methods of surface preparation.
    a. Use abrasive blast-cleaning methods if recommended by the paint manufacturer.
    b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application. Do not pant surface where moisture content exceeds that permitted in manufacturer's printed directions.
    c. Clean concrete floors to be painted win 5%solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia and rinse; allow drying and vacuuming before painting.
3. Wood: Clean surfaces of dirt, oil and other foreign substances with scrapers, mineral spirits and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
    a. Scrape and Clean small, dry, seasons knots and apply a thin coat of white shellac or other recommended knot sealer before application of primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler. Sand smooth when dried.
    b. Seal tops, bottoms and cut-outs of unprimed wood doors with a heavy coast of varnish or sealer immediately upon delivery.
4. Ferrous Metals: Clean non-galvanized ferrous-metal surfaces that have no been shop-coated; remove oil, grease, dirt,, loose mill scale and other foreign substance. Use solvent or mechanical cleaning methods that comply with recommendations of the Steel Structures Painting Council.
    a. Treat bare and sandblasted or pickled-clean metal with metal treatment wash coat before priming.
    b. Touch-up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by the paint manufacturer, and touch-up with the same primer as the shop coat.
5. Galvanized Surface; Clean galvanized surfaces with non-petroleum-based solvents so that the surface is free of oil and surface contaminates. Remove pre-treat from galvanized sheet metal fabricated from coil stock by mechanical methods.

C. Materials Preparation: carefully mix and prepare paint materials in accordance with manufacturer's directions.
    1. Maintain containers used in mixing and application of paint in a lean condition, free of foreign materials and residua.
    2. Stir material before application to produce a mixture of uniform density; stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.
    3. Use only thinners approved by the paint manufacture, and only within recommended limits.
D. Tinting: Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade pf undercoats to distinguish each separate coat; surfaces or conditions otherwise detrimental to formation of a durable paint film.

3.3 APPLICATION

A. General:
    1. Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.
    2. Do not paint over dust, rust, scale, grease, moisture, scuffed surfaces or conditions detrimental to formation of a durable paint film.
    3. Paint colors, surface treatments and finish are indicated in "schedules"
    4. Provide finish coats that are compatible with primer used.
    5. The number of coats and film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Send between applications where sanding is required to produce an even smooth surface in accordance with the manufacturer's directions.

6. Apply additional coats when undercoats, stains or other conditions show through final coat of paint until film is of uniform finish, color and appearance. Give special attention to ensure that surface, including edges, corners, crevices, welds and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
7. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned tube radiation, grilles and similar components are in place. Extent coatings n these areas as required to maintain the system integrity and provide desired protection.
8. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment of furniture with prime coat only before final installation of equipment.
9. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.
10. Paint backsides of access panels and removable or hinged covers to match exposed surfaces.
11. Finish exterior doors on tops, bottoms and side edges same as exterior faces.
12. Sand lightly between each seceding enamel or varnish coat.
13. Omit primer on metal surfaces that have been shop-primed and touch-up painted.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pre-treated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

C. Minimum Coating Thickness: Apply materials at not less than the manufacturer's recommended spreading rate. Provide a total dry film thickness of the entire system as recommended by the manufacturer.

D. Block-Fillers: Apply block-fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

E. Prime Coats: Before application of finish coats, apply a prime coat of material as recommended by the manufacturer to material that is required to be painted or finished and has not been prime-coated by others. Re-coat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears to assure a finish coat with no burn-through or other defects due to insufficient sealing.

F. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform, color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness or other surface imperfections will not be acceptable.
1. Use electrostatic spray equipment for application of prime and finish coats on painted metal surfaces or provide masking and temporary enclosures to prevent over spray on adjacent surfaces.

G. Complete Work: Match approved samples for color, texture and coverage. Remove, refinish or repaint work not compliance with specified requirements.

3.4 FIELD QUALITY CONTROL

A. The Owner reserves the right to invoke the following test procedure at any time and as often as the Owner deems necessary during the period when paint is being applied:
1. The Owner will engage the services of an independent testing laboratory to sample the paint material being used. Samples of material delivered to the project will be taken, identified, sealed and certified in the presence of the Contractor.
2. The testing laboratory will perform appropriate test for the following characteristics as required by the Owner:
a. Quantitative materials Analysis
b. Abrasion Resistance
c. Apparent Reflectivity
d. Flexibility
e. Washability
f. Absorption
g. Accelerated Weathering
h. Dry Opacity
i. Accelerated Yellowness
j. Re-Coating

k. Skinning
l. Color Retention
m. Alkali and Milder Resistance

3. If test results show material being used does not comply with specified requirements, the Contractor may be directed to stop painting, remove non-complying paint, pay for testing, repaint surfaces coated with rejected paint, and remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the two coatings are non-compatible.

3.5 CLEANING

A. Clean-up: At the end of each work day, remove cans, rags, rubbish and other discarded paint materials from the site.

3.6 PROTECTION

A. Protect work of other trades, whether to be painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.
B. Provide: wet paint" signs to protect newly-painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.
   1. At completion of construction activities of other trades, touch-up and restore damaged or defaced-painted surfaces.

END OF SECTION

SECTION 10425 - SIGNS

1.1 GENERAL – Include an Allowance in the Amount of $10,000.00 for Signage and Building Plaque. Style, type and specifications for signage to be determined after Bid Award.

A. SUBMITTALS

1. Drawings: Provide Plans, elevations, and sections showing typical members, anchors, layout, reinforcement, accessories, and installation details. Include the following:
   a. Message List for each sign with wording and letter layout.
   b. Setting Drawings, templates, and directions for installing anchors.
   c. Full-size spacing templates for dimensional letters.
   d. Furnish full-size rubbings for metal plaques.

B. UL and NEMA Compliance: Provide electrical components that are labeled and listed by UL and comply with applicable NEMA Standards.

1.2 PRODUCTS

A. For Interior: Plastic Laminate: High-pressure plastic laminate engraving stock with face and core plies in contrasting colors.
B. For Exterior: Bronze metal
C. Fasteners: Concealed, non-corrosive metal.
D. Anchors and Inserts: Nonferrous metal or hot-dipped galvanized. Use toothed steel or lead expansion bold devices for drilled-in-place anchors. Furnish inserts for concrete masonry work
E. Brackets: Fabricated brackets and fittings from extruded aluminum to suit panel construction and mounting conditions. Factory-Paint brackets color matching background color of sign panel.
F. Graphic Content and Style: Provide sign copy that complies with size, style, spacing, content, position, material, finishes, and color of letters, numbers, and other graphic devices.

1.3 EXECUTIONS

A. Installation: Locate signs in accordance with Texas Accessibility Standards for State of Texas (verify with Architect) using mounting methods specified by manufacturer. Install level, plumb, and at the heights in accordance with local code and with T.A.S. with sign surfaces free from distortion or other defects in appearance.

B. Dimensional Letters and Numbers: Mount characters using methods recommended for letter form, type of mounting, wall construction, and condition of exposure indicated. Provide heavy paper template to establish letter spacing and to locate holes for fasteners.
   1. Flush Mounting: Backs in contact with wall surface.

C. Cleaning: After Installation, clean soiled surfaces. Protect units from damage until acceptance by the owner.

END OF SECTION

SECTION 10520 - FIRE EXTINGUISHERS AND CABINETS

PART 1: GENERAL

1.01 WORK INCLUDED
A. Fire Extinguishers
B. Cabinets
Provide a Minimum of 6 Cabinets and 6 Extinguishers

1.02 RELATED WORK
A. Section 09900-Field Painting

1.03 REFERENCES
A. NFPA 10-Portable Fire Extinguishers
B. UBC 43-6 (ASTM E814-83) - Fire rated cabinets fabricated in accordance to perform.
C. Americans with Disabilities Act 1990- Maximum 4" cabinet projection for corridors.

1.04 QUALITY ASSURANCE
A. Conform to NFPA 10 requirements for portable fire extinguishers.
B. Provide fire extinguishers, cabinets and accessories by a single manufacturer.
C. Conform to Americans with Disabilities Act 1990 on maximum cabinet projection of Cabinets in corridors where necessary.

1-05 SUBMITTALS
A. Submit brochures and product data in compliance with Section 1300

PART 2: PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS
A. Provide fire extinguishers, cabinets, accessories manufactured by J.L. Industries, Inc., 4450 West 78th Street Circle, Bloomington, MN

2.02 FIRE EXTINGUISHERS
A. Dry Chemical Type: J. L. Industries Cosmic 10E

2.03 FIRE EXTINGUISHER CABINETS
A. Provide J.L's Ambassador Series, model number 1017W10 with SAF-T-LOK door. Door and trim to be fabricated from cold-rolled steel or approved substitution.

PART 3: EXECUTION

3.01 INSTALLATION
A. Install items included in this section in locations and at mounting heights indicated, or if not indicated, at heights to comply with applicable regulations of governing authorities.
1. Prepare recesses in walls for fire extinguisher cabinets as required by type and size of cabinet and style of trim and to comply with manufacturers instructions.
2. Securely fasten mounting brackets and fire extinguisher cabinets to structure, square and plumb, to comply with manufacturer’s instructions.

END OF SECTION

SECTION 10801 - TOILET AND BATH ACCESSORIES

1.1 GENERAL

A. Submittals: Manufacturer's Product Data. Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified.

B. Product Options: Accessory requirements, including those for materials, finishes, dimensions, capacities, and performance, are established by specific products indicated in the Toilet and Bath Accessory Schedule.

1. Products of other manufacturers with equal characteristics, as judged solely by Architect, may be provided.
2. Products of other listed manufacturers with equal characteristics, as judged solely by Architect, may be provided.
3. Other manufacturers' products with equal characteristics may be considered. See Division 1 Section "Substitutions."
4. Do not modify aesthetic effects, as judged solely by Architect, except with Architect's approval. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.
5. All products to meet or exceed IBC 2012 ADA and TAS requirements

1.2 PRODUCTS

A. Manufacturers: Subject to compliance with requirements, provide accessories by one of the following or equal to.

1. Toilet and Bath Accessories (Those not supplied under contract by Owner's Supplier)
   a. A & J Washroom Accessories, Inc.
   b. American Specialties, Inc.
   c. Bobrick Washroom Equipment, Inc.
   d. Bradley Corporation.
   e. General Accessory Manufacturing Co. (GAMCO).
   f. McKinney/Parker Washroom Accessories Corp.

B. Toilet Accessories (Those not supplied under contract by Owner's Supplier

1. Grab Bar:
   a. Stainless Steel.
   b. Outside Diameter: 1 ¼ to 1½ inches.
   c. Wall Thickness: Minimum 18 gage (0.050 inch).
   d. Grasping surface finish: Nonslip.
   e. Mounting: Concealed.
   f. Clearance between wall and inside of grab bar: 1 ½ inches.
   g. Basis of Design: Model No. 0852" American Specialties Inc.
2. Sanitary Napkin Disposal Unit:
   a. Basis of Design: Model No. 0852: American Specialties, Inc.

C. Materials: As follows:

1. Stainless Steel: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.0312-inch (0.8-mm) minimum nominal thickness, unless otherwise indicated.
2. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q2, nominal 6.0 mm thick, with silvering, electroplated copper coating, and protective organic coating complying with FS DD-M-411.
3. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

4. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.
5. Keys: Provide universal keys for internal access to accessories for servicing and re-supplying. Provide minimum of six keys to Owner's representative.

1.3 EXECUTION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
   1. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.
   2. Install 1 1/4” O.D. grab bars to withstand a downward load of at least 250 lb when tested according to method in ASTM F 446.
B. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.
C. Remove temporary labels and protective coatings.
D. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION

SECTION 12361 QUARTZ COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Quartz countertops.
2. Setting materials and accessories.

B. Related Sections:
1. Division 01: Administrative, procedural, and temporary work requirements.
2. Section [__ __ __ - _____] - Steel supports.
3. Section [__ __ __ - _____] - Wood supports.
4. Section [__ __ __ - _____] - Cementitious backer unit substrate.
5. Section [__ __ __ - _____] - Base cabinets.
6. Section [__ __ __ - _____] - Joint sealers.
7. Section [__ __ __ - _____] - Toilet Accessories.

1.2 REFERENCES

A. American National Standards Institute (ANSI):
1. A108.5 - Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar.
2. A118.4 - Latex-Portland Cement Mortar.

B. ASTM International (ASTM:
1. C97 - Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone.
2. C99 - Standard Test Method for Modulus of Rupture of Dimension Stone.
3. C170 - Standard Test Method for Compressive Strength of Dimension Stone.
4. C241 - Standard Test Method for Abrasion Resistance of Stone Subjected to Foot Traffic.
5. C482 - Standard Test Method for Bond Strength of Ceramic Tile to Portland Cement.
6. C484 - Standard Test Method for Thermal Shock Resistance of Glazed Ceramic Tile.
7. C531 - Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
8. C648 - Standard Test Method for Breaking Strength of Ceramic Tile.
9. C650 - Standard Test Method for Resistance of Ceramic Tile to Chemical Substances.
10. C672/C672M - Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals.
11. C880 - Standard Test Method for Flexural Strength of Dimension Stone.
12. C1026 - Standard Test Method for Measuring the Resistance of Ceramic Tile to Freeze-Thaw Cycling.
13. C1028 - Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.
14. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

A. Shop Drawings: Include countertop layout, dimensions, materials, finishes, cutouts, and attachments.
B. Samples:
1. 3 x 3 inch quartz samples in specified color.
2. 3 inch long joint sealer samples in specified color.

1.4 QUALITY ASSURANCE

A. Fabricator and Installer Qualifications: Minimum 2 years documented experience in work of this Section.
B. Mockup:
1. Construct countertop mockup, at one restroom, full depth, with splash and skirt.
2. Include plumbing fixtures and trim
3. Approved mockup may remain as part of the Work.

1.5 WARRANTY

A. Provide manufacturer's 10 year warranty against defects in materials and workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Contract Documents are based on products by Cosentino USA, Inc.
B. Substitutions: Not permitted.

2.2 MATERIALS

A. Quartz Sheet:
   1. Product: Silestone or Cambria
   2. Composition: Quartz aggregate, resin, and color pigments formed into flat slabs.
   3. Anti-microbial protection: Microban by Microban International, Inc., integral to sheet.
   4. Color: To be selected from manufacturer’s full color range.
   5. Thickness:
   6. Physical characteristics:
      a. Static coefficient of friction: 1.02 dry, 0.51 wet, tested to ASTM C1028.
      b. Water absorption: Maximum 0.03 percent, tested to ASTM C97.
      c. Compressive strength: Minimum 29,000 psi, tested to ASTM C170.
      d. Bond strength: Minimum 210 psi, tested to ASTM C482.
      e. Modulus of rupture: Minimum 6300 psi, tested to ASTM C99.
      f. Flexural strength: Minimum 5800 psi, tested to ASTM C880.
      g. Breaking strength: Minimum 480 lbf, tested to ASTM C648.
      h. Stain resistance: Not affected by 10 percent hydrochloric acid or 10 percent KOH, tested to ASTM C650.
      i. Thermal shock resistance: Pass 5 cycles, tested to ASTM C484.
      j. Abrasive index: 65-Ha = 25, tested to ASTM C241.
      k. Thermal expansion: 1.670 x 10^{-5} in/in/deg F, tested to ASTM C531.
      l. Deicing resistance: Rating of 0, tested to ASTM C672/C672M.
      m. Freeze/thaw resistance: 0 tiles at 15 cycles, tested to ASTM C1026.
      n. Flame spread rating: Class 1, tested to ASTM E84.

2.3 ACCESSORIES

A. Adhesive: Type recommended by quartz manufacturer.
B. Latex-Portland Cement Mortar: 272 Premium Floor N’ Wall Thin-Set Mortar mixed with 333 Super Flexible Additive by Laticrete International, Inc.
C. Latex-Portland Cement Mortar: ANSI A118.4.
D. Joint Sealer:
   1. Latisil Tile and Stone Sealant by Laticrete International, Inc.
   2. Color: To be selected from manufacturer’s full color range.

2.4 FABRICATION

A. Cut quartz panels accurately to required shapes and dimensions.
B. Radius exposed edges.
C. Fabricate with hairline joints.
D. Cut holes for sinks, faucets and accessories and pass thru trays if used.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean surfaces to receive countertops; remove loose and foreign matter than could interfere with adhesion.

3.2 INSTALLATION

A. Install countertops in accordance with manufacturer’s instructions and approved Shop Drawings.
B. Set in thin set mortar bed in accordance with ANSI A 108.5.
C. Set plumb and level. Align adjacent pieces in same plane.
D. Install with hairline joints.
E. Fill joints between countertops and adjacent construction with joint sealer; finish smooth and flush.

3.3 INSTALLATION TOLERANCES

A. Maximum variation from level and plumb: 1/8 inch in 10 feet, noncumulative.
B. Maximum variation in plane between adjacent pieces at joint: Plus or minus 1/16 inch.

3.4 CLEANING

A. Clean countertops in accordance with manufacturer's instructions.

3.5 PROTECTION

A. Protect installed countertops with non-staining sheet coverings.

END OF SECTION

SECTION 019113 - GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Basis-of-Design documentation is referenced for information only, and not included here.

1.2 SUMMARY

A. Section Includes:

1. General requirements for coordinating and scheduling commissioning.
2. Commissioning meetings.
3. Commissioning reports.
4. Equipment and systems installation, startup, and field quality-control testing indicated in the Contract Documents.
5. Use of test equipment, instrumentation, and tools for commissioning.
6. System readiness checklists, including, but not limited to, installation checks, startup, performance tests, and performance test demonstration.
7. Commissioning tests and commissioning test demonstration.
8. Work to correct commissioning issues.
9. Work to repeat tests when equipment and systems fail acceptance criteria.
10. Adjusting, verifying, and documenting identified systems and assemblies.

B. Related Requirements:

1. Section 013300 "Submittal Procedures" for submittal procedures requirements for commissioning.
2. Section 017700 "Closeout Procedures" for certificate of Construction Phase Commissioning Completion submittal requirements.
3. Section 017823 "Operation and Maintenance Data" for preliminary operation and maintenance data submittal.
4. Section 230800 "Commissioning of HVAC" for technical commissioning requirements for HVAC.
5. Section 260800 "Commissioning of Electrical Systems" for technical commissioning requirements for electrical systems.

1.3 DEFINITIONS

A. Acceptance Criteria: Threshold of acceptable work quality or performance specified for a commissioning activity, including, but not limited to, system readiness checklists, performance tests, performance test demonstrations, commissioning tests and commissioning test demonstrations.

B. Basis-of-Design Document (BoD): A document prepared by Engineer, or Commissioning Authority that records concepts, calculations, decisions, and product selections used to comply with Owner's Project Requirements and to suit applicable regulatory requirements, standards, and guidelines.

C. Commissioning Authority (CxA): An entity engaged by Owner, and identified in Section 011000 "Summary," to evaluate Commissioning-Process Work.

D. Commissioning Plan: A document, prepared by Commissioning Authority, that outlines the organization, schedule, allocation of resources, and documentation requirements of commissioning.

E. Commissioning (Cx): A quality-focused process for verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, and tested to comply with Owner's Project Requirements. The requirements specified here are limited to the construction phase commissioning activities. The scope of commissioning is defined in this section and is in accordance with the requirements in the IECC.

F. Construction Phase Commissioning Completion: The stage of completion and acceptance of commissioning when resolution of deficient conditions and issues discovered during commissioning and retesting until acceptable results are obtained has been accomplished. Owner will establish in writing the date Construction Phase Commissioning Completion is achieved. See Section 017700 "Closeout Procedures" for certificate of Construction Phase Commissioning Completion submittal requirements.

1. Commissioning is complete when the work specified in this Section and related Sections has been completed and accepted, including, but not limited to, the following:

    a. Completion of tests and acceptance of test results.
    b. Resolution of issues, as verified by retests performed and documented with acceptance of retest results.
    c. Comply with requirements in Section 017900 "Demonstration and Training."
    d. Completion and acceptance of submittals and reports.

G. Functional Test: Test of dynamic function of systems, as opposed to components, under full operation in various modes through all control system’s sequences of operation using manual (direct observation) or monitoring methods following prescribed test procedures in sequential written form

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

I. Owner's Witness: Commissioning Authority, Owner's Project Manager, or Architect-designated witness authorized to authenticate test demonstration data and to sign completed test data forms.

J. Construction or System readiness Checklist: List, provided by Commissioning Authority to installer, of items to inspect and elementary component tests to conduct to verify proper installation of equipment prior to functional testing.

K. Sampling: Functionally testing only a fraction of total number of identical or near identical pieces of equipment.

L. Seasonal Commissioning: Testing of equipment that can be done only during periods of peak heating or cooling, when HVAC equipment is operating at full-load or heavy-load conditions.

M. Simulated Condition: Condition created for purpose of testing response of system.

N. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they shall mean "as-built" systems, assemblies, subsystems, equipment, and components.

O. Test: Performance tests, performance test demonstrations, commissioning tests, and commissioning test demonstrations.

P. Trending: Monitoring using building control system.

1.4 COMPENSATION

A. Should Architect, Commissioning Authority, other Owner's witness, or Owner's staff perform additional services or incur additional expenses due to actions of Contractor listed below, compensate Owner for such additional services and expenses.

1. Failure to provide timely notice of commissioning activities schedule changes.
2. Failure to meet acceptance criteria for test demonstrations.

B. Contractor shall compensate Owner for such additional services and expenses at the rate of $150.00 per labor hour plus $100.00 per round trip plus per diem allowances for meals and lodging according to current U.S. General Services Administration (GSA) Per Diem Rates.

1.5 COMMISSIONING TEAM

A. Members Appointed by Contractor(s):

1. Commissioning Coordinator: A person or entity employed by Contractor to manage, schedule, and coordinate commissioning.
2. Project superintendent and other employees that Contractor may deem appropriate for a particular portion of the commissioning.
3. Subcontractors, installers, suppliers, and specialists that Contractor may deem appropriate for a particular portion of the commissioning.
4. Appointed team members shall have the authority to act on behalf of the entity they represent.

B. Members Appointed by Owner:

1. Commissioning Authority (CxA), plus consultants that CxA may deem appropriate for a particular portion of the commissioning.

a. CxA: Ethos Engineering, Mark Warren, PE. Cell (512) 563-3495

2. Owner representative(s), facility operations and maintenance personnel, plus other employees, separate contractors, and consultants that Owner may deem appropriate for a particular portion of the commissioning.

    a. Owner's Rep: Director of Facilities and Construction.

3. Architect, plus employees and consultants that Architect may deem appropriate for a particular portion of the commissioning.

    a. Architect: K+ Architects

4. MEP Engineer, plus employees and consultants that Architect may deem appropriate for a particular portion of the commissioning.

    a. MEP: Ethos Engineering, Guillermo Quintanilla. Cell (956) 564-2811.

1.6 INFORMATIONAL SUBMITTALS

A. Comply with requirements in Section 013300 "Submittal Procedures" for submittal procedures general requirements for commissioning.

B. Commissioning Plan Information:

1. List of Contractor-appointed commissioning team members to include specific personnel and subcontractors to the performance of the various commissioning requirements.
2. Schedule of commissioning activities, integrated with the construction schedule. Comply with requirements in Section 013200 "Construction Progress Documentation" for construction schedule general requirements for commissioning.
3. Contractor personnel and subcontractors to participate in each test.
4. List of instrumentation required for each test to include identification of parties that will provide instrumentation for each test.

C. Commissioning schedule.

D. Two-week look-ahead schedules.

E. Test Reports:

1. Pre-Startup Report: Prior to startup of equipment or a system, submit signed, completed system readiness checklists.
2. Test Data Reports: At the end of each day in which tests are conducted, submit test data for tests performed.
3. Commissioning Issues Reports: Daily, at the end of each day in which tests are conducted, submit commissioning issue reports for tests for which acceptable results were not achieved.
4. Weekly Progress Report: Weekly, at the end of each week in which tests are conducted, submit a progress report.
5. Data Trend Logs: Submit data trend logs at the end of the trend log period.

6. System Alarm Logs: Daily, at the start of days following a day in which tests were performed, submit print-out of log of alarms that occurred since the last log was printed.

F. System readiness checklists:

1. Material checks.
2. Installation checks.
3. Startup procedures, where required.

1.7 CLOSEOUT SUBMITTALS

A. Commissioning Report:

1. At Construction Phase Commissioning Completion, include the following:

a. Pre-startup reports.
b. Test data forms, completed and signed.
c. Commissioning issues report log.
d. Commissioning issues reports showing resolution of issues.
e. Correspondence or other documents related to resolution of issues.
f. Other reports required by commissioning.
g. List unresolved issues and reasons they remain unresolved and should be exempted from the requirements for Construction Phase Commissioning Completion.
h. Report shall include commissioning work of Contractor.

B. Request for Certificate of Construction Phase Commissioning Completion.

C. Operation and Maintenance Data: For proprietary test equipment, instrumentation, and tools to include in operation and maintenance manuals.

1.8 COMMISSIONING TEAM RESPONSIBILITIES

A. COMMISSIONING AUTHORITY: Responsibilities of the CxA during the Construction Phase include the following:
1. Coordinate and direct steps of the total Commissioning Process for systems being installed as part of this contract. Coordinate commissioning work schedule with Owner and Contractor.
2. Provide Commissioning Plan.
3. Attend planning and construction-site meetings as required to obtain information relating to Commissioning Process. Convene commissioning team meetings as required.
4. Plan and conduct commissioning scoping and coordination meetings. Provide notice to all Team members to attend scheduled commissioning meetings.
5. Request all information required for Commissioning Process from manufacturers, Contractor, and Design Professionals.
6. Verify that systems and equipment have been installed and started in accordance with manufacturer’s recommendations and with generally recognized construction standards, and that documentation of such has been provided.
7. Assist in resolving discrepancies.

8. Prepare System readiness checklists to ensure systems have been installed according to project specifications. Verify that System readiness checklists have been addressed by Contractor and are accurate. Deliver final System readiness checklists to Owner.
9. Prepare Functional Test procedures to demonstrate performance of systems according to project specifications. Observe and document performance of systems, as per process detailed in Functional Test procedures.
10. Verify the execution of commissioning process activities using random sampling. The sampling rate may vary from 1 to 100 percent. Verification will include, but is not limited to, equipment submittals, system readiness checklists, training, operating and maintenance data, tests, and test reports to verify compliance with the OPR. When a random sample does not meet the requirement, the CxA will report the failure in the Issues Log.
11. Prepare and maintain an Issues Log.
12. Compile test data, inspection reports, and certificates; include them in the systems manual and commissioning process report.
13. Review testing and balancing (TAB) reports; notify Owner of deficiencies.
14. Recommend acceptance or non-acceptance of systems to Owner.
15. Verify that training has taken place by collecting training documentation from Contractor.
16. Compile and maintain commissioning record.
17. Provide pre-final and final commissioning reports to all commissioning team members. The report shall include:
    a. Communications between Owner, CxA, Design Professionals, Vendors, and/or Contractor and Subcontractors related to Commissioning Process.
    b. Minutes of commissioning meetings.
    c. Findings and pertinent observations.
    d. A listing of any deficiencies, unresolved issues, and compromises in the environmentally responsive features.
    e. Manufacturer's start-up reports.
    f. An Issues Log which:
        1) Describes design, installation, and performance issues which are at variance with the Owner's project requirements and Contract Documents.
        2) Identifies and tracks issues as they are encountered, documenting the status of unresolved and resolved issues.
        3) Documents corrective modifications made.
    g. System readiness checklists.
    h. Testing plans and Functional Test reports.
    i. Listing of off-season test(s) not performed and a schedule for their completion.
18. Conduct an inspection of the building and its systems within 10 months after substantial completion and prior to the expiration of warranties. Prepare a report documenting findings that should be addressed prior to expiration of warranties.

B. CONTRACTOR: Responsibilities of the General Contractor (GC) as related to Commissioning Process include, but are not limited to the following:
1. Facilitate coordination of Commissioning work by CxA.
2. Attend Commissioning meetings or other meetings called by CxA to facilitate the Commissioning Process.
3. Integrate and coordinate commissioning process activities with construction schedule.
4. Review CxA's Functional Test procedures for feasibility, safety, and impact on warranty, and provide CxA with written comment on same.

5. Provide all documentation relating to manufacturer's recommended performance testing of equipment and systems.
6. Provide Operations and Maintenance Data to CxA for preparation of checklists and training manuals.
7. Provide testing and balancing report.
8. Provide As-built drawings and documentation to facilitate Functional Testing.
9. Assure and facilitate participation and cooperation of specialty subcontractors (electrical, mechanical, Building Automation, etc.), and equipment suppliers as required for the Commissioning Process.
10. Require subcontractors to inspect systems installed and fill-out System readiness checklists (provided by CxA) to verify installation has taken place in accordance with manufacturer's instructions, and in a workmanlike manner in accordance with project documents and generally accepted construction practices. Certify to CxA that installation work listed in System readiness checklists has been completed and accompany CxA during verification of completed System readiness checklists.
11. Install systems and equipment in strict conformance with project specifications, manufacturer's recommended installation procedures, and System readiness checklists, as prepared by CxA.
12. Provide data concerning performance, installation, and start-up of systems.
13. Provide copy of manufacturer's filled-out start-up forms for equipment and systems.
14. Ensure systems have been started and fully checked for proper operation prior to arranging for Functional Testing with CxA. Prepare and submit to CxA written certification that each piece of equipment and/or system has been started according to manufacturer's recommended procedure, and that system has been tested for compliance with operational requirements.
    a. GC shall carry out manufacturer's recommended start-up and testing procedures, regardless of whether or not they are specifically listed in CxA's Functional Test procedures.
    b. GC is not relieved of obligation for systems / equipment demonstration where performance testing is required by specifications, but a Functional Performance Test is not specifically designated by CxA.
15. Coordinate with CxA to determine mutually acceptable date of Functional Performance Tests.
16. Review and accept construction checklists provided by the CxA.
17. Direct and coordinate commissioning testing among subcontractors, suppliers, and vendors.
18. Complete commissioning process test procedures.
19. Provide qualified personnel to assist and participate in Commissioning.
20. Provide test instruments and communications devices, as prescribed by CxA and where identified in this specifications manual, as required for carrying out Functional Testing of systems.
21. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
22. Cooperate with the CxA for resolution of issues recorded in the Issues Log.
23. Ensure deficiencies found in the Commissioning Process are corrected within the time schedule shown in the CA report.
24. Provide CxA with all submittals, start-up instructions manuals, operating parameters, and other pertinent information related to Commissioning Process. This information shall be provided directly to the CxA as a digital PDF file at the same time that the submittals are made to the architect and/or engineer.
25. Prepare and submit to CxA proposed Training Program outline for each system.

26. Coordinate and provide training of Owner's personnel. Provide CxA with proposed training agenda no less than 14 days prior to scheduled training sessions. Provide documentation that training took place (including system being trained on, trainer's name and contact information, sign-in sheet verifying who attended training, length of training, and signature of owner's authorized person certifying training took place satisfactorily).
27. Prepare Operation and Maintenance manuals and As-Built drawings in accordance with specifications; submit copy to CxA in addition to other contractually required submissions. Revise and resubmit manuals in accordance with Design Professionals and CxA's comments.
28. All costs associated with the participation of GC, Sub-Contractors, Design Professionals, and Equipment Vendors in the Commissioning Process shall be included as part of the Construction Contract.

C. Subcontractors and vendors shall prepare and submit to Commissioning Authority Manufacturer's installation and performance test procedures to demonstrate performance of systems according to these specifications and checklists prepared by Commissioning Authority.

D. Owner's Representative: Responsibilities of the Owner's Representative as related to Commissioning Process include, but are not limited to the following:

1. Provide the OPR documentation to the CxA and GC for information and use.
2. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.
3. Provide the BoD documentation, prepared by Architect and approved by Owner, to the CxA and GC for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.
4. Manage contracts of Architect and GC.
5. Arrange for facility operating and maintenance personnel to attend various field commissioning activities and field training sessions.
6. Provide final approval for completion of Commissioning Work.
7. Warranty Period: Ensure that seasonal or deferred testing and deficiency issues are addressed.

E. Architect: Responsibilities of the Architect as related to Commissioning Process include, but are not limited to the following:

1. Attend commissioning scoping meeting and other commissioning team meetings as requested by Commissioning Authority and as selected by Architect.
2. Perform normal submittal review, construction observation, record drawing preparation, and operations and maintenance data preparation, as required by Contract Documents.
3. Coordinate resolution of system deficiencies identified during commissioning, as required by Contract Documents. Review Commissioning Issues Logs and issue directives to GC and/or Design Professionals as applicable.
4. Prepare and submit final as-built design intent documentation for inclusion in Operation and Maintenance Data Manual, and review and approve Operation and Maintenance Data Manual.
5. Review Commissioning Report and issue directive to resolve all outstanding deficiencies prior to project close-out.
6. Warranty Period: Coordinate resolution of design non-conformance and design deficiencies identified during warranty period commissioning.

F. Design Professionals Responsible for Design of Each Portion of Work Being Commissioned:

1. Perform normal submittal review, construction observations, and record drawing preparation, as required by Contract Documents. Perform site observation immediately preceding system startup.
2. Respond to deficiencies identified by Commissioning Authority as directed by Architect.
3. Provide design narrative and sequence documentation requested by Commissioning Authority. Assist, along with GC, in clarifying operation and control of commissioned equipment in areas where specifications, control drawings, or equipment documentation are not sufficient for writing detailed testing procedures.
4. Attend commissioning scoping meetings and other commissioning team meetings as requested by Commissioning Authority and as selected by Architect or responsible design professional.
5. Participate in resolution of system deficiencies identified during commissioning, as required by Contract Documents.
6. Prepare and submit final as-built design intent and operating parameters documentation for inclusion in Operation and Maintenance Manual, and review and approve Operation and Maintenance Manual.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT, INSTRUMENTATION, AND TOOLS

A. Test equipment and instrumentation required to perform the commissioning shall remain the property of Contractor unless otherwise indicated.

2.2 REPORT FORMAT AND ORGANIZATION

A. General Format and Organization:

1. Bind report in three-ring binders.
2. Label the front cover and spine of each binder with the report title, volume number, project name, Contractor's name, and date of report.
3. Record report on compact disk.
4. Electronic Data: Portable document format (PDF); a single file with outline-organized bookmarks for major and minor tabs and tab contents itemized for specific reports.

B. Commissioning Report:

1. Include a table of contents and an index to each test.
2. Include major tabs for each Specification Section.
3. Include minor tabs for each test.
4. Within each minor tab, include the following:

a. Test specification.
b. Pre-startup reports.
c. Test data forms, completed and signed.

d. Commissioning issue reports, showing resolution of issues, and documentation related to resolution of issues pertaining to a single test. Group data forms, commissioning issue reports showing resolution of issues, and documentation related to resolution of issues for each test repetition together within the minor tab, in reverse chronological order (most recent on top).

PART 3 - EXECUTION

3.1 PREPARATION

A. Review preliminary system readiness checklists and preliminary test procedures and data forms.

3.2 GENERAL

A. Authority
1. The Commissioning Authority carries out the Cx responsibilities as the Owner's authorized agent in accordance with plans, specifications, and contractual requirements.
2. CxA reports deficiencies found to the GC, Architect and Owner.
3. The Architect evaluates deficiencies and issues directive to GC to remedy CxA's deficiencies lists, in accordance with contract documents.
4. No change in scope work is to take place without express written consent of Owner. Any deficiencies identified by CxA that are deemed by Architect to be outside of the scope of work shall be discussed with Owner for consideration.
5. GC and CxA are to copy Architect on all correspondence related to the commissioning process.

B. Participation In The Commissioning Process
1. GC shall attend meetings related to Commissioning process and arrange for attendance by subcontractors and vendors prior to commissioning of their systems, at the discretion of CxA.
2. Provide skilled technicians to start and test all systems, and place systems in complete and fully functioning service in accordance with contract documents and design intent.
3. Provide skilled technicians, experienced and familiar with systems being commissioned, to assist CxA in commissioning process.
4. Attend initial commissioning team scoping meeting, pre-commissioning meetings specific to each system, and other meetings requested by CxA as required to discuss resolution of deficiencies.
5. Coordinate with sub-Contractors and equipment vendors/representatives to set aside adequate time to address System readiness Checklists, Functional Testing, Operations and Maintenance Training, and associated coordination meetings.

C. Work Prior To Testing
1. A commissioning team scoping meeting shall be held at a time and place designated by Commissioning Authority. Owner, Architect, Commissioning Authority, Contractor, and Mechanical, Electrical, and Controls Contractors, shall be present at this meeting. The main objectives of the meeting are to familiarize all parties with the requirements of the commissioning process; to ensure that the responsibilities of each party are clearly

understood; and obtain information to develop the preliminary commissioning plan, including:

a. Personnel representing the various entities participating in the process (GC, subcontractors, Owner, Architect, Engineer, CxA)
b. Lines of communications;
c. Assignment of responsibilities;
d. Review system readiness checklists;
e. Submittal schedule;
f. Preliminary construction schedule

2. Following the initial commissioning team scoping meeting, and upon reviewing submittals, CxA shall prepare a preliminary Commissioning Plan outlining procedures and responsibilities, including names and contact information of responsible parties, tentative dates for commissioning activities, and system readiness checklists. Preliminary Commissioning Plan shall be distributed to GC and Owner electronically for review and comment. CxA shall modify the Commissioning Plan based on feedback from GC and Owner and will generate a final Cx Plan.
3. Prior to system readiness and functional testing, CxA will conduct site inspections at critical times and issue Cx Field Reports with observations on installation deficiencies so that they may be issued by Architect as deemed appropriate
4. GC shall complete all phases of the work so the systems can be started, tested, adjusted, balanced, and otherwise commissioned.
5. GC shall verify requirements of Divisions 21, 22, 23 and 26 outlining responsibilities for start-up of equipment with obligations to complete systems, including all sub-systems so that they are fully functional.
6. A minimum of fourteen (14) days prior to date of system readiness performance test, submit to Commissioning Authority for review, detailed description of equipment start-up procedures which GC proposes to perform to demonstrate conformance of systems to specifications and commissioning checklists.
7. Convene system-specific pre-commissioning meetings prior to start of system readiness testing of each system. The GC shall hold a pre-commissioning meeting with all Team members in attendance. The purpose of the meeting is to review the system readiness checklists, and equipment start-up procedures for each system to be commissioned, confirm that systems are ready for testing, and define a schedule for testing activities.

D. System readiness checks and functional performance tests

1. The GC shall provide all materials, services, and labor required to operate equipment and/or system in order to perform the system readiness checks and functional performance tests. A system readiness check or functional performance test shall be aborted if any system deficiency prevents the successful completion of the test or if any participating commissioning team member of which participation is specified is not present for the test. The GC shall reimburse the Owner and A/E for all costs associated with effort lost due to tests that are aborted. These costs shall include salary, travel costs and per diem (where applicable).
2. Functional performance tests may sometimes duplicate the checking, testing, and inspection methods established in related Sections. Where checking, testing, and inspection methods are not specified in other Sections, methods shall be established which will provide required information. Testing and verification required by this section shall be performed during the Commissioning phase. Requirements in related Sections are independent from the requirements of this Section and shall not be used to satisfy any of the requirements specified in this Section without the approval of CxA.

3. Follow start-up and initial checkout procedures listed in article titled "RESPONSIBILITIES" in Part 1, and additional requirements specified in this Section. Divisions 22, 23 and 26 have startup responsibilities and are required to complete systems and sub-systems so systems are fully functional, meeting design requirements of Contract Documents. Commissioning procedures and functional testing do not relieve or lessen this responsibility or shift this responsibility, in whole or in part, to Commissioning Agent or Owner.

E. Work To Resolve Deficiencies
1. Complete corrective work in a timely manner to allow expeditious completion of commissioning process. If deadlines pass without resolution of identified problems, Owner reserves the right to obtain supplementary services and/or equipment to resolve the problem. Costs thus incurred will be GC's responsibility.

3.3 SUSTAINABILITY REQUIREMENTS

A. Comply with requirements listed in specifications and drawings as it relates to sustainability features that will be verified during the Commissioning process.

3.4 SYSTEM READINESS CHECKLISTS

A. General
1. System readiness checklists are important to ensure that equipment and systems are properly connected and operational, and installed in accordance with specifications, drawings, manufacturer's requirements, and all applicable codes.
2. Checklists ensure that functional performance testing (in-depth checkout) may proceed without unnecessary delays.
3. Performance of system readiness checklists, startup, and checkout shall be directed and executed by subcontractor or vendor. Only individuals that have direct knowledge and who witnessed that line item task on system readiness checklist was performed shall initial or check item off.
4. Each piece of equipment and major distribution system receive full system readiness checkout. No sampling strategies are used.
5. System readiness checkout for given system must be successfully completed prior to formal functional performance testing of equipment or subsystems of given system.

B. System readiness Checklist
1. System readiness performance tests shall be documented in a checklist format, as prepared and provided by CxA, for each piece of equipment. Each checklist shall be initialed by GC, verifying that all items on checklist have been addressed and completed.
2. Commissioning System readiness checklists are not to preclude GC from applying his own construction inspection checklists.
3. All system elements shall be checked to verify that they have been installed, adjusted, and calibrated properly, that all connections have been made correctly, and that it is ready to function as specified. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, control sequence, and other conditions which may cause damage.
4. Verify that tests, meter readings and specific electrical characteristics agree with those required by equipment or system manufacturer.

5. All discrete elements and sub-systems shall be adjusted and shall be checked for proper operation. Verify wiring and support components for equipment are complete and tested.
6. Do not conduct start-up procedure recommended by equipment/system manufacturer at prior to system readiness testing.
7. Subcontractors shall clearly list outstanding items of initial start-up and system readiness procedures that were not completed successfully at bottom of procedures form or on separate sheet attached to form. Completed forms and attached sheets shall be provided to Commissioning Authority within 2 days of test completion. Installing subcontractor or vendor shall correct deficient or incomplete areas in timely manner and shall submit updated system readiness checklist and startup report with statement of correction on original non-compliance report.
8. When system readiness checklists for a particular system or subsystems are completed, GC will request verification by CxA. GC and subcontractors shall accompany CxA during system readiness checklist verification.
9. If during system readiness checklist verification, CxA finds a significant number of deficiencies, GC shall have all the checklists associated with similar system redone.

3.5 SYSTEM START-UP

A. GC will arrange for start-up of operating equipment and systems after (or at the same time as) system readiness testing and prior to scheduling Functional Testing.

B. Start-up of equipment and systems shall be performed only by a manufacturer's representative, or person(s) who are specifically manufacturer-approved. All start-up personnel shall be trained and authorized, experienced and knowledgeable in the operations of such equipment and systems.

C. Coordinate schedule for start-up of various equipment and systems so that subsystems required for major systems operation are tested first.

D. Manufacturer's start-up reports must be submitted to CxA prior to scheduling Functional Testing.

3.6 FUNCTIONAL TESTING

A. The objective of Functional Testing is to demonstrate that each system is operating according to documented design intent and Contract Documents, through all possible modes of operation.

B. GC and sub-Contractors shall include in his bid proposal all costs associated with preparation and execution of Testing Procedures for all systems to be commissioned.

C. Functional testing is intended to begin upon completion of each system and after system readiness checklists have been completed. Functional testing may proceed prior to completion of systems or sub-systems at discretion of Commissioning Authority. Beginning system testing before completion does not relieve GC from fully completing system, including system readiness checklists as early as possible.

D. GC and sub-Contractors shall provide detailed Testing Procedures that will allow all items on checklists to be verified.

E. Testing shall be conducted under specified operating conditions as recommended or approved by Commissioning Authority.

F. A Functional Performance Test shall be performed on each complete system. Each function shall be demonstrated to the satisfaction of Commissioning Authority in accordance with proposed test procedures developed to demonstrate compliance with specifications.

G. Each Functional Test shall be witnessed and signed off by Commissioning Authority upon satisfactory completion. Functional Test is not to be considered complete until Owner accepts Commissioning Authority's recommendation for completion.

H. All elements of system shall be tested to demonstrate that total systems satisfy all requirements of these specifications. Testing shall be accomplished on hierarchical basis. Test each piece of equipment for proper operation, followed by each subsystem, followed by the entire system, followed by any inter-ties to other major systems.

I. Notification, Scheduling Of Functional Testing and Re-Testing
   1. Notify CxA and Owner, in writing, of request for scheduling Functional Testing. Submit request no fewer than five days prior to desired date for beginning functional testing.
      a. GC must certify that systems and equipment are functioning satisfactorily, according to specifications and design intent, prior to requesting Functional Testing. Upon receipt of such certification, CxA will schedule with GC a time for the particular system test.
         1) CxA will attempt to schedule Functional Testing when convenient for GC and his vendors, and to minimize lost time to GC.
      b. GC will resolve all deficiencies identified during initial test prior to submitting request, in writing, for re-testing. Such request for re-testing shall certify that GC has resolved all deficiencies, or list reason why any deficiencies remain which cannot be resolved.
      c. CxA will re-test to ensure that all deficiencies have been resolved.
         1) Deficiencies that were not detected in first Functional Test, but are discovered in subsequent re-testing, are to be resolved by GC as if they had been discovered in initial testing.

J. Functional Testing Requirements And Procedures
   1. GC and sub-Contractors shall perform tests in the presence of CxA. Tests not witnessed by CxA shall not be considered complete.
   2. To facilitate Functional Testing, when requested by CxA, GC shall provide services of personnel to accompany CxA for the duration of Functional Testing, including any follow-up testing. Such personnel must be experienced, qualified, and intimately familiar with the system being tested.
      a. Participation by representative(s) of direct digital controls (DDC) systems is of particular importance in Functional Testing. All systems which are controlled and/or monitored by DDC are to be thoroughly tested, point by point, through all modes of operation, with the assistance of manufacturer's representative. DDC graphics, setpoints, and programming are to be included as a part of Functional Testing as well.
      b. GC must provide services of personnel to accompany CxA for equipment and systems which may pose particular health and safety concerns, such as boilers.
      c. Should he fail to provide representative to accompany CxA during Functional Testing, GC continues to bear full responsibility for equipment warranty. Owner

and CxA will not be held responsible for damage to equipment, or other actions which might impact warranty, when performing Functional Testing of systems where GC has not provided authorized accompanying representative to operate equipment.

3. Each system shall be operated through all modes of operation including, but not limited to seasonal, occupied, unoccupied, warm-up, cool-down, part-load, and full-load, where system response is specified.
    a. For multiple units, sampling strategy established by Commissioning Authority and subject to approval of Owner may be used.
    b. Verification of each sequence in sequences of operation is required.
    c. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, and the like, shall also be tested.
4. Where possible, inspections carried out on systems by local Authorities Having Jurisdiction (AHJ) may serve as Functional Testing for purposes of Commissioning.
    a. CxA will accompany AHJ during testing procedures required by AHJ.
    b. It is responsibility of GC to arrange for testing by AHJ and to coordinate with CxA to find mutually convenient times for testing. Provide CxA a minimum of four days in advance of intent to schedule testing by AHJ.
    c. CxA will issue a separate report on results of testing.
    d. CxA reserves the right to require additional testing, should testing by AHJ not adequately cover all system components in all modes of operation.
5. Functional Testing is to be dedicated solely to testing of equipment and systems, and not to resolution of deficiencies. Deficiencies identified during testing process must be corrected by GC at a time other than during Functional Testing.
6. Within six days of performing functional test, CxA will issue test report with findings a list of deficiencies that must be addressed by GC or sub-Contractors.
7. Commissioning Authority shall submit a Final Report to Owner recommending acceptance or non-acceptance of individual system components as well as the systems as a whole.

K. Re-Testing And Failure To Remedy Deficiencies
1. Despite GC's best efforts to ensure systems are problem-free, it is expected that some deficiencies will be found during initial inspection of System readiness Checklist, and during initial Functional Testing; such deficiencies are expected to be minimal.
2. It is GC's responsibility to remedy identified deficiencies, both in System readiness Checklist and in Functional Testing phases of work, in a timely and thorough manner.
3. It is GC's responsibility to ensure that all deficiencies are corrected prior to requesting a re-inspection or re-test of systems and equipment. Do not request re-inspection or re-test until deficiencies are corrected.
    a. At his discretion, CxA may agree to re-testing systems or equipment where deficiencies remain which are beyond GC's control to resolve expeditiously.
    b. Typically such re-testing of incomplete systems and equipment will take place only if remaining deficiencies are minor in scope and nature, and are of such nature that they cannot be resolved in a timely manner (such as those due to difficulties in obtaining parts, or where Owner has requested a change that has delayed work, etc.)
4. CxA will carry out a second re-inspection or re-test of systems and equipment subsequent to receiving GC's request.
    a. If CxA finds deficiencies identified in initial inspection or test have not been remedied (with exception of un-resolvable deficiencies noted above), and such

remaining deficiencies are significant enough to require additional inspection or re-testing, GC will be back-charged for CxA's expenses, per Article 1.5.

3.7 DEFERRED TESTING

A. "Seasonal Commissioning" pertains to testing during peak heating or cooling seasons when HVAC equipment is operating at full-load or heavy-load conditions. Initial commissioning will be done as soon as contract work is completed, regardless of season. Seasonal Commissioning under full- or heavy-load conditions other than the current season will be handled at later time by GC and CxA.
   1. If adequate load may be artificially placed upon heating or cooling equipment, CxA, at his discretion, may perform functional testing during non-peak load periods.
   2. GC is to provide services of personnel and participate in seasonal testing process in the same manner as he would in non-seasonal testing.
   3. Until off-season commissioning can be accomplished, Owner may retain an amount from GC's payment sufficient to cover the cost of off-season testing.

B. Unforeseen Deferred Tests: If any check or test cannot be completed due to building structure, required occupancy condition, or other reason, execution of checklists and functional testing may be delayed upon approval of Owner. Tests shall be conducted in same manner as seasonal tests, as soon as possible. Services of required parties will be negotiated. Make final adjustments to Operation and Maintenance Manuals and record drawings due to unforeseen deferred tests.
   1. GC is to provide services of personnel and participate in deferred testing in the same manner as he would for normal commissioning.
   2. Until deferred testing can be accomplished, Owner may retain an amount from GC's payment sufficient to cover the cost of deferred testing.

3.8 TRAINING

A. The following requirements are in addition to operation and maintenance requirements specified elsewhere in this specifications manual. GC shall be responsible for training coordination and scheduling, and ultimately to ensure that training is completed.

B. Scheduling
   1. Organize training to fit Owner's schedule and to optimize the learning experience. Limit continuous sessions to no more than four hours, or otherwise only as approved by Owner and/or Architect.
   2. Provide an outline of the proposed training agenda for review by Owner and CxA a minimum of 10 days prior to proposed date for training session.
   3. Provide CxA a minimum 5 days advance notice of intent to carry out a training session.
   4. The CxA will not be required to attend all training sessions for building personnel, but will attend selected sessions and monitor progress and content.
   5. No training will take place prior to successful completion of Functional Testing.

C. Training Materials
   1. Develop Training Manuals to meet requirements of individual equipment specification sections.

2. Operating and Maintenance Manuals alone are NOT considered training manuals. O&M Manuals may be used as reference, but shall not be considered to meet requirements for training materials.
3. Develop a detailed outline showing how training program will be organized, including classroom and hands-on training as required by individual specifications sections.
4. Provide with training materials, a quick-reference "how-to" index which will allow operators to easily access information included in Training Manuals and/or O&M Manuals. This reference will include, as a minimum; routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions.
5. Refer to individual equipment or system specifications for minimum material to be covered as part of the training program.

D. Documentation
1. All training sessions are to be fully documented. Document:
   a. Basic information on training session (name of system, time, date, and location of training, name of presenter, length of training session, etc.).
   b. Names of persons who attended the training session (provide a sign-in sheet).
   c. Signature from authorized Owner’s representative indicating that training took place and was satisfactory.
2. Provide CxA copy of sign-in sheet with training session documentation.

3.9 O&M MANUALS

A. Provide operation and maintenance manuals as specified in section 017700 Closeout Submittals, and as outlined in individual sections of Divisions 22, 23 and 26.

B. Provide CxA with a single copy of Operation and Maintenance Manuals for review. CxA’s copy of O&M manuals shall be submitted through Architect.

C. CxA shall review O&M Manuals and submit comments through the Architect.

3.10 SYSTEMS TO BE COMMISSIONED

A. Refer to commissioning specifications sections in Related Sections, including the following:
1. 230100 - COMMISSIONING OF MECHANICAL SYSTEMS: HVAC and Controls.
2. 260100 - COMMISSIONING OF ELECTRICAL SYSTEMS: Lighting and Lighting Controls.

END OF SECTION 019113

SECTION 077200 - ROOF ACCESSORIES

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: New factory fabricated roof curb and roof curb adapters that can receive windstorm certification. Coordinate with Structural.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, materials, dimensions of individual components and profiles, and finishes.

B. Coordination Drawings: Roof plans drawn to scale and coordinating penetrations and roof-mounted items. Show the following:
   1. Size and location of roof accessories specified in this Section.
   2. Method of attaching roof accessories to roof or building structure.
   3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
   4. Coordinate dimensions with shop drawings of equipment to be supported.

1.4 QUALITY ASSURANCE

A. Substitutions: Requests for substitution shall be submitted in writing at least 10 days prior to bid date and shall be accompanied by product literature and samples. No substitution will be permitted after bid date.

B. Standards: Comply with the following:
   1. SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.
   2. NRCA's "Roofing and Waterproofing Manual" details for installing units.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. G-90 galvanized steel with paint-grip coating.

B. Insulation: Manufacturer's standard rigid or semirigid glass-fiber board of 2” thickness, 1-1/2lb density, R8 value.

C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, complying with AWPA C2; not less than 1-1/2 inches thick.

D. Fasteners: Stainless steel metal as recommended by manufacturer. Match finish of exposed fasteners with finish of material being fastened.

E. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.

F. Bituminous Coating: SSPC-Paint 12, solvent-type bituminous mastic, nominally free of sulfur and containing no asbestos fibers, compounded for 15-mil dry film thickness per coating.

G. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

H. Elastomeric Sealant: Generic type recommended by unit manufacturer that is compatible with joint surfaces; ASTM C 920, Type S, Grade NS, Class 25, and Uses NT, G, A, and, as applicable to joint substrates indicated, O.

I. Roofing Cement: ASTM D 4586, nonasbestos, fibrated asphalt cement designed for trowel application or other adhesive compatible with roofing system.

2.2 ROOF CURBS

A. General: Provide roof curbs capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported on roof curbs. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

B. Fabrication: Unless otherwise indicated or required for strength, fabricate units from minimum 16 gauge, galvanized steel with paint grip coating, with welded corners and with seams joined by continuous water and air-tight welds. Tack or spot welding is unacceptable.
1. All external welds shall be prepared and coated with corrosion inhibitor compound.
2. Curb and curb adapter walls shall be insulated with 1-1/2” thick, three-pound density insulation. Exposed edges shall be encapsulated to ensure no insulation erodes into the air stream. Insulation shall be either foil faced or coated with antimicrobial coating such that the fibers are not airborne over the life of the building.
3. Provide preservative-treated wood nailers at tops of curbs and formed flange at perimeter bottom for mounting to roof.
4. Provide formed cants and base profile coordinated with roof insulation thickness.
5. The Manufacturer shall limit static pressure gain to .25 inches/water gauge
6. Fabricate units to minimum height of 18 inches, unless otherwise indicated.
7. Changes in airflow direction to be accomplished by 90-degree elbows with turning vanes.
8. Curb and curb adapters shall be manufactured in one piece except when width exceeds 108”. If width exceeds 108”, the curb shall be designed with prefabricated joints for ease of installation. It will be manufactured in separate pieces with the number and length of the pieces determined by the total length of the unit. The Manufacturer shall supply drawings for assembly and installation.
9. Curb and curb adapters shall provide full support of the new unit and shall include 3/8” gasketing.
10. Counter flashing shall extend over the original curb a minimum of 1” and be welded and weatherproof.

2.3 FINISHES, GENERAL

A. Surface preparation: Oil, grease and other deposits of surface contamination shall be removed by solvent or detergent washing. All surfaces must be clean, dry and free of any dirt, dust, grease, oil or other deleterious materials prior to coating. Care shall be taken to ensure surfaces remain clean before and during coating process.

B. Application system:
   1. Coating shall provide a standard 5 year manufacturer's limited warranty.
   2. Finish metal surfaces with a corrosion protection system equal to the following:
      a. Energy Guard ZRU Primer. Finish coat shall consist of EnergyGuard DCC Cabinet Casing polyurethane coating. Coatings shall be applied by a certified applicator and shall result in a finish with an ASTMB117-90 salt spray rating of 10,000 hours.
      b. Prime coat of ICI Devran 201 Universal Epoxy Primer to thickness of not less than 3.o mils DFT (dry film thickness) nor more than 8.0 mils DFT. Minimum recoat time for Devran 201 Universal Epoxy Primer is 3.5 hours at 77 F with 80% RH. Finish coat shall consist of Devthane 379 UVA Aliphatic Urethane Gloss Enamel applied to thickness of not less than 1.0 mils DFT nor more than 5.0 mils DFT.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written instructions. Coordinate installation of roof accessories with installation of roof deck, roof insulation, flashing, roofing membranes, penetrations, equipment, and other construction involving roof accessories to ensure that each element of the Work performs properly and that combined elements are waterproof and weather tight. Anchor roof accessories securely to supporting structural substrates so they are capable of withstanding lateral and thermal stresses, and inward and outward loading pressures.

B. Separation: Separate metal from incompatible metal or corrosive substrates, including wood, by coating concealed surfaces, at locations of contact, with bituminous coating or providing other permanent separation.

C. Flange Seals: Unless otherwise indicated, set flanges of accessory units in a thick bed of roofing cement to form a seal.

D. Cap Flashing: Where required as component of accessory, install cap flashing to provide waterproof overlap with roofing or roof flashing (as counter flashing). Seal overlap with thick bead of mastic sealant.

E. Operational Units: Test-operate units with operable components. Clean and lubricate joints and hardware. Adjust for proper operation.

3.2 CLEANING AND PROTECTION

A. Clean exposed surfaces according to manufacturer's written instructions. Touch up damaged metal coatings.

END OF SECTION 077200

SECTION 077300 - WIND LOAD RATED ROOF CURBS AND RESTRAINT BRACKETS

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. Design, construct, furnish and install roof curbs and curb adapters, brackets and related items to meet governing building codes, as demonstrated by comprehensive analysis that the load resisting capabilities meet or exceed requirements.

1.3 QUALITY ASSURANCE

A. Meet requirements of the International Building Code, ASCE Std 7, TDI, and other applicable codes for the location. This specification shall be a minimum requirement for wind load design consideration, and is not intended as a substitute for legislated, more stringent, national, state or local requirements.

B. Wind-induced forces shall be determined by governing code requirements.
   1. Wind-generated force shall be reduced into an equivalent statically applied force.
   2. The statically applied force shall act in horizontal and vertical directions at the center of gravity of the rooftop mounted equipment, resulting in torsion, flexure, tension and shear forces that the wind restraint brackets shall be shown to be able to resist.

C. Install products in strict accordance with applicable codes and manufacturers' standards. Whenever a conflict occurs between the manufacturers or construction standards, the most stringent shall apply.

1.4 SUBMITTALS

A. Manufacturer's statement showing that the curbs and wind load restraint brackets meet the applicable code requirements, signed and sealed by a licensed professional engineer (PE). Provide the following:
   1. Wind restraint calculations for all connections of rooftop-mounted equipment to roof curb, and roof curb to the structure.
   2. Drawings showing curbs, wind restraint bracket dimensions, make and model compatible with rooftop unit, including type of connection hardware required.

PART 2 - PRODUCTS

2.1 ROOF CURBS, ADAPTERS, AND RESTRAINTS

A. Approved manufacturers of roof curbs and wind load restraint brackets:
   1. Curbs Plus, Complete Curbs, Thybar Corporation.
   2. Others shall obtain a written pre-approval one week prior to bidding.

B. Products shall be made of a material (Prime G-90 galvanized steel or galvalume) compatible with roof curb and the rooftop unit base-rail material. Dissimilar metals shall not to be used.
   1. Fully welded mitered corners for wind load consideration
   2. Base flange attachments for securing curb to structure.
   3. Factory installed wood nailer for attachment of roofing material.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's written instructions.

B. Attach rooftop equipment to roof curbs with wind load restraint brackets of size, type and quantity as determined by equipment manufacturer.

C. Attach roof curb to the building structure at the curb base flanges. Base flange attachment options include anchor bolts, welded connections and mechanical fasteners.

D. Do not install wind load restraint brackets in a manner that will result in inadequate maintenance access, base-rail damage, or roof curb reduced weight carrying capacity.

E. Prior to performing installation of restraint brackets, notify Engineer of any conflicts with other trades or equipment that may result in undesirable contact due to inadequate space or other unforeseen conditions. Notify Engineer of any discrepancies between the specifications and field conditions or changes required due to specific equipment selection prior to installation.

F. Corrective work necessitated by discrepancies or conflicts after installation shall be at the contractor's expense.

3.2 INSPECTION

A. On completion of installation, inspect the completed system and report in writing any installation error or other faults in the system that could affect the wind load resistant capabilities of the roof top assembly.

B. The Contractor shall submit a report to the project designer, including the above report with consequent steps taken to properly complete the wind load restraint installation.

END OF SECTION

SECTION 210517 - SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 STACK-SLEEVE FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Smith, Jay R. Mfg. Co.
2. Zurn Industries, LLC.

B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Metraflex Company (The).
4. Pipeline Seal and Insulator, Inc.
5. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. HOLDRITE.

B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. 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.

3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

5. Using grout, seal the space around outside of stack-sleeve fittings.

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade: Cast-iron wall sleeves.

2. Exterior Concrete Walls below Grade: Cast-iron wall sleeves with sleeve-seal system.
   a. Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade: Cast-iron wall sleeves with sleeve-seal system.
   a. Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade: Galvanized-steel-pipe sleeves

5. Interior Partitions: Galvanized-steel-pipe sleeves

END OF SECTION 210517

SECTION 210518 - ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

D. Split-Casting Brass Type: With polished, chrome-plated and rough-brass finish and with concealed hinge and setscrew.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Insulated Piping: One-piece, stamped-steel type.
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
e. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
f. Bare Piping in Equipment Rooms: One-piece, cast-brass type with rough-brass finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.
2. Existing Piping: Split-casting, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 210518

SECTION 211313 - WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Cover system for sprinkler piping.
3. Specialty valves.
4. Sprinklers.
5. Alarm devices.
6. Manual control stations.
7. Control panels.
8. Pressure gages.

B. Verify fire line flow and pressure test data with Civil Engineer. If available flow and pressure are not adequate, provide a fire pump as required.

C. Related Requirements:

1. Section 211119 "Fire Department Connections" for exposed-, flush-, and yard-type fire department connections.

1.3 DEFINITIONS

A. Standard Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure higher than standard 175 psig.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For wet-pipe sprinkler systems.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittal: For wet-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Domestic water piping.
2. Compressed air piping.
3. HVAC hydronic piping.
4. Ductwork.
5. Plumbing systems.
6. Items penetrating finished ceiling include the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.

B. Qualification Data: For qualified Installer and professional engineer.

C. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

D. Welding certificates.

E. Fire-hydrant flow test report.

F. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

G. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

    a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional certified at NICET Level 3 or higher.

B. Welding Qualifications: Qualify procedures and operators according to 2010 ASME Boiler and Pressure Vessel Code.

1.9 FIELD CONDITIONS

A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:

1. Notify Architect no fewer than 7 days in advance of proposed interruption of sprinkler service.
2. Do not proceed with interruption of sprinkler service without Architect's written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13.
2. NFPA 13R.

B. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

C. Delegated Design: Engage a qualified professional, as defined in Section 014000 "Quality Requirements," to design wet-pipe sprinkler systems.

1. Coordinate fire-hydrant flow test records with Architect and Civil Engineer.

2. Sprinkler system design shall be approved by authorities having jurisdiction.

    a. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
    b. Sprinkler Occupancy Hazard Classifications:
        1) Building Service Areas: Ordinary Hazard, Group 1.
        2) Electrical Equipment Rooms: Ordinary Hazard, Group 1.

3) General Storage Areas: Ordinary Hazard, Group 1.
4) Libraries except Stack Areas: Light Hazard.
5) Library Stack Areas: Ordinary Hazard, Group 2.
6) Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
7) Office and Public Areas: Light Hazard.
8) Classrooms: Light Hazard.

3. Minimum Density for Automatic-Sprinkler Piping Design:
   a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
   b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
   c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. area.
   d. Special Occupancy Hazard: As determined by authorities having jurisdiction.

4. Maximum Protection Area per Sprinkler: According to UL listing.
5. Maximum Protection Area per Sprinkler:
   a. Office Spaces: 120 sq. ft.
   b. Storage Areas: 130 sq. ft.
   c. Mechanical Equipment Rooms: 130 sq. ft.
   d. Electrical Equipment Rooms: 130 sq. ft.
   e. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.

6. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated:
   a. Light-Hazard Occupancies: 100 gpm for 30 minutes.
   b. Ordinary-Hazard Occupancies: 250 gpm for 60 to 90 minutes.

2.2 STEEL PIPE AND FITTINGS

A. Standard-Weight, Galvanized- and Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.

B. Schedule 30, Galvanized- and Black-Steel Pipe: ASTM A 135/A 135M; ASTM A 795/A 795M, Type E; or ASME B36.10M wrought steel, with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.

C. Galvanized- and Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.

D. Galvanized- and Uncoated-Steel Couplings: ASTM A 865/A 865M, threaded.

E. Malleable- or Ductile-Iron Unions: UL 860.

F. Cast-Iron Flanges: ASME 16.1, Class 125.

G. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

H. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.

1. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

I. Grooved-Joint, Steel-Pipe Appurtenances:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anvil International.
b. Corcoran Piping System Co.
c. Shurjoint Piping Products.
d. Tyco Fire & Building Products LP.
e. Victaulic Company.

2. Pressure Rating: 175-psig minimum.

3. Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting, with dimensions matching steel pipe.
4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

J. Steel Pressure-Seal Fittings: UL 213, FM Global-approved, 175-psig pressure rating with steel housing, rubber O-rings, and pipe stop; for use with fitting manufacturers' pressure-seal tools.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Victaulic Company.

2.3 PIPING JOINING MATERIALS

A. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

B. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

C. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 LISTED FIRE-PROTECTION VALVES

A. General Requirements:

1. Valves shall be UL listed or FM approved.
2. Minimum Pressure Rating for Standard-Pressure Piping: 175 psig.

B. Ball Valves:

1. Manufacturers:

a. Anvil International, Inc.
b. Victaulic Company.

2. Standard: UL 1091 except with ball instead of disc.
3. Valves NPS 1-1/2 and Smaller: Bronze body with threaded ends.
4. Valves NPS 2 and NPS 2-1/2: Bronze body with threaded ends or ductile-iron body with grooved ends.
5. Valves NPS 3: Ductile-iron body with grooved ends.

C. Bronze Butterfly Valves:
1. Manufacturers:

a. Fivalco Inc.
b. Global Safety Products, Inc.
c. Milwaukee Valve Company.

2. Standard: UL 1091.
3. Pressure Rating: 175 psig.
4. Body Material: Bronze.
5. End Connections: Threaded.

D. Iron Butterfly Valves:
1. Manufacturers:

a. Anvil International, Inc.
b. Fivalco Inc.
c. Global Safety Products, Inc.
d. Kennedy Valve; a division of McWane, Inc.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Pratt, Henry Company.
h. Shurjoint Piping Products.
i. Tyco Fire & Building Products LP.
j. Victaulic Company.

2. Standard: UL 1091.
3. Pressure Rating: 175 psig.
4. Body Material: Cast or ductile iron.
5. Style: wafer.
6. End Connections: Grooved.

E. Check Valves:
1. Manufacturers:

a. AFAC Inc.
b. American Cast Iron Pipe Company; Waterous Company Subsidiary.
c. Anvil International, Inc.
d. Crane Co.; Crane Valve Group; Crane Valves.
e. Crane Co.; Crane Valve Group; Jenkins Valves.
f. Crane Co.; Crane Valve Group; Stockham Division.
g. Fire Protection Products, Inc.
h. Fivalco Inc.
i. Globe Fire Sprinkler Corporation.
j. Groeniger & Company.

k. Kennedy Valve; a division of McWane, Inc.
l. Matco-Norca.
m. Metraflex, Inc.
n. Milwaukee Valve Company.
o. Mueller Co.; Water Products Division.
p. NIBCO INC.
q. Potter Roemer.
r. Reliable Automatic Sprinkler Co., Inc.
s. Shurjoint Piping Products.
t. Tyco Fire & Building Products LP.
u. United Brass Works, Inc.
v. Venus Fire Protection Ltd.
w. Victaulic Company.
x. Viking Corporation.
y. Watts Water Technologies, Inc.

2. Standard: UL 312.
3. Pressure Rating: 250 psig minimum.
4. Type: Swing check.
5. Body Material: Cast iron.
6. End Connections: Flanged or grooved.

F. Bronze OS&Y Gate Valves:
1. Manufacturers:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. Milwaukee Valve Company.
d. NIBCO INC.
e. United Brass Works, Inc.

2. Standard: UL 262.
3. Pressure Rating: 175 psig.
4. Body Material: Bronze.
5. End Connections: Threaded.

G. Iron OS&Y Gate Valves:
1. Manufacturers:

a. American Cast Iron Pipe Company; Waterous Company Subsidiary.
b. American Valve, Inc.
c. Clow Valve Company; a division of McWane, Inc.
d. Crane Co.; Crane Valve Group; Crane Valves.
e. Crane Co.; Crane Valve Group; Jenkins Valves.
f. Crane Co.; Crane Valve Group; Stockham Division.
g. Hammond Valve.
h. Milwaukee Valve Company.
i. Mueller Co.; Water Products Division.
j. NIBCO INC.
k. Shurjoint Piping Products.
l. Tyco Fire & Building Products LP.

m. United Brass Works, Inc.
n. Watts Water Technologies, Inc.

2. Standard: UL 262.
3. Pressure Rating: 250 psig minimum.
4. Body Material: Cast or ductile iron.
5. End Connections: Flanged or grooved.

H. Indicating-Type Butterfly Valves:
1. Manufacturers:

a. Anvil International, Inc.
b. Fivalco Inc.
c. Global Safety Products, Inc.
d. Kennedy Valve; a division of McWane, Inc.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Shurjoint Piping Products.
h. Tyco Fire & Building Products LP.
i. Victaulic Company.

2. Standard: UL 1091.
3. Pressure Rating: 175 psig minimum.
4. Valves NPS 2 and Smaller:

a. Valve Type: Ball or butterfly.
b. Body Material: Bronze.
c. End Connections: Threaded.

5. Valves NPS 2-1/2 and Larger:

a. Valve Type: Butterfly.
b. Body Material: Cast or ductile iron.
c. End Connections: Flanged, grooved, or wafer.

6. Valve Operation: Integral electrical, 115-V ac, prewired, single-circuit, supervisory switch indicating device.

I. NRS Gate Valves:
1. Manufacturers:

a. American Cast Iron Pipe Company; Waterous Company Subsidiary.
b. American Valve, Inc.
c. Clow Valve Company; a division of McWane, Inc.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Kennedy Valve; a division of McWane, Inc.
f. Mueller Co.; Water Products Division.
g. NIBCO INC.
h. Tyco Fire & Building Products LP.

2. Standard: UL 262.

3. Pressure Rating: 250 psig minimum
4. Body Material: Cast iron with indicator post flange.
5. Stem: Nonrising.
6. End Connections: Flanged or grooved.

J. Indicator Posts:
1. Manufacturers:

a. American Cast Iron Pipe Company; Waterous Company Subsidiary.
b. American Valve, Inc.
c. Clow Valve Company; a division of McWane, Inc.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Kennedy Valve; a division of McWane, Inc.
f. Mueller Co.; Water Products Division.
g. NIBCO INC.
h. Tyco Fire & Building Products LP.

2. Standard: UL 789.
3. Type: Horizontal for wall mounting.
4. Body Material: Cast iron with extension rod and locking device.
5. Operation: Hand wheel.

2.5 TRIM AND DRAIN VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating: 175 psig minimum.

2.6 SPECIALTY VALVES

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

B. Pressure Rating:

1. Standard-Pressure Piping Specialty Valves: 175-psig minimum.

C. Body Material: Cast or ductile iron.

D. Size: Same as connected piping.

E. End Connections: Flanged or grooved.

F. Alarm Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Globe Fire Sprinkler Corporation.

b. Reliable Automatic Sprinkler Co., Inc. (The).
c. Tyco Fire & Building Products LP.
d. Victaulic Company.

2. Standard: UL 193.

3. Design: For horizontal or vertical installation.
4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.
5. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
6. Drip Cup Assembly: Pipe drain with check valve to main drain piping.
7. 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

G. Automatic (Ball Drip) Drain Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Reliable Automatic Sprinkler Co., Inc. (The).
b. Tyco Fire & Building Products LP.

2. Standard: UL 1726.

3. Pressure Rating: 175-psig minimum.
4. Type: Automatic draining, ball check.
5. Size: NPS 3/4.
6. End Connections: Threaded.

2.7 HOSE CONNECTIONS

A. Manufacturers:

1. AFAC Inc.
2. Central Sprinkler Corp.
3. Elkhart Brass Mfg. Co., Inc.
4. Fire-End and Croker Corp.
5. Fire Protection Products, Inc.
6. GMR International Equipment Corporation.
7. Grinnell Fire Protection.
8. Guardian Fire Equipment Incorporated.
9. McWane, Inc.; Kennedy Valve Div.
10. Mueller Company.
11. Potter-Roemer; Fire-Protection Div.
12. United Brass Works, Inc.

B. Description: UL 668, brass or bronze, 300-psig minimum pressure rating, hose valve for connecting fire hose. Include **angle or gate** pattern design; female NPS inlet and male hose outlet; and lugged cap, gasket, and chain. Include NPS 1-1/2 or NPS 2-1/2 as indicated, and hose valve threads according to NFPA 1963 and matching local fire department threads.

1. Valve Operation: Nonadjustable type, unless pressure-regulating type is indicated.
2. Finish: Rough chrome-plated.

2.8 FIRE-DEPARTMENT CONNECTIONS

A. Exposed-Type, Fire-Department Connection:
1. Manufacturers:

a. AFAC Inc.
b. Elkhart Brass Mfg. Company, Inc.
c. Fire-End & Croker Corporation.
d. Fire Protection Products, Inc.
e. GMR International Equipment Corporation.
f. Guardian Fire Equipment, Inc.
g. Tyco Fire & Building Products LP.
h. Wilson & Cousins Inc.

2. Standard: UL 405.
3. Type: Exposed, projecting, for wall mounting.
4. Pressure Rating: 175 psig minimum.
5. Body Material: Corrosion-resistant metal.
6. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
7. Caps: Brass, lugged type, with gasket and chain.
8. Escutcheon Plate: Round, brass, wall type.
9. Outlet: Back, with pipe threads.
10. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE, or AUTO SPKR."
11. Finish: Rough brass or bronze.

B. Flush-Type, Fire-Department Connection:
1. Manufacturers:

a. AFAC Inc.
b. Elkhart Brass Mfg. Company, Inc.
c. GMR International Equipment Corporation.
d. Guardian Fire Equipment, Inc.
e. Potter Roemer.

2. Standard: UL 405.
3. Type: Flush, for wall mounting.
4. Pressure Rating: 175 psig minimum.
5. Body Material: Corrosion-resistant metal.
6. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
7. Caps: Brass, lugged type, with gasket and chain.
8. Escutcheon Plate: Rectangular, brass, wall type.
9. Outlet: With pipe threads.
10. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE or AUTO SPKR."

11. Finish: Polished chrome plated.

C. Yard-Type, Fire-Department Connection:
1. Manufacturers:

a. AFAC Inc.
b. Elkhart Brass Mfg. Company, Inc.
c. Fire-End & Croker Corporation.
d. Fire Protection Products, Inc.
e. GMR International Equipment Corporation.
f. Guardian Fire Equipment, Inc.
g. Wilson & Cousins Inc.

2. Standard: UL 405.
3. Type: Exposed, freestanding.
4. Pressure Rating: 175 psig minimum.
5. Body Material: Corrosion-resistant metal.
6. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
7. Caps: Brass, lugged type, with gasket and chain.
8. Escutcheon Plate: Round, brass, floor type.
9. Outlet: Bottom, with pipe threads.
10. Sleeve: Brass.
11. Sleeve Height: 18 inches.
12. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE or AUTO SPKR."
13. Finish, Including Sleeve: Rough brass or bronze.

2.9 SPRINKLER PIPING SPECIALTIES

A. Branch Outlet Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anvil International.
b. Shurjoint Piping Products.
c. Tyco Fire & Building Products LP.
d. Victaulic Company.

2. Standard: UL 213.

3. Pressure Rating: 175-psig minimum.
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Type: Mechanical-tee and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Flow Detection and Test Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AGF Manufacturing Inc.
   b. Reliable Automatic Sprinkler Co., Inc. (The).
   c. Tyco Fire & Building Products LP.
   d. Victaulic Company.

2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

3. Pressure Rating: 175-psig minimum.
4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded or grooved.

C. Branch Line Testers:

1. Standard: UL 199.

2. Pressure Rating: 175 psig.
3. Body Material: Brass.
4. Size: Same as connected piping.
5. Inlet: Threaded.
6. Drain Outlet: Threaded and capped.
7. Branch Outlet: Threaded, for sprinkler.

D. Sprinkler Inspector's Test Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AGF Manufacturing Inc.
   b. Tyco Fire & Building Products LP.
   c. Victaulic Company.

2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

3. Pressure Rating: 175-psig minimum.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

E. Adjustable Drop Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. Corcoran Piping System Co.

2. Standard: UL 1474.

3. Pressure Rating: 250-psig minimum.
4. Body Material: Steel pipe with EPDM-rubber O-ring seals.
5. Size: Same as connected piping.
6. Length: Adjustable.
7. Inlet and Outlet: Threaded.

F. Flexible Sprinkler Hose Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. FlexHead Industries, Inc.
   b. Victaulic Company.

2. Standard: UL 1474.

3. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
4. Pressure Rating: 175-psig minimum.
5. Size: Same as connected piping, for sprinkler.

2.10 SPRINKLERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Globe Fire Sprinkler Corporation.
2. Reliable Automatic Sprinkler Co., Inc. (The).
3. Tyco Fire & Building Products LP.
4. Victaulic Company.

B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

C. Pressure Rating for Residential Sprinklers: 175-psig maximum.

D. Pressure Rating for Automatic Sprinklers: 175-psig minimum.

E. Pressure Rating for High-Pressure Automatic Sprinklers: 250-psig minimum.

F. Automatic Sprinklers with Heat-Responsive Element:

1. Early-Suppression, Fast-Response Applications: UL 1767.
2. Nonresidential Applications: UL 199.
3. Residential Applications: UL 1626.
4. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

G. Open Sprinklers with Heat-Responsive Element Removed: UL 199.

H. Sprinkler Finishes: Chrome plated, bronze and painted. Coordinate with Architect.

I. Special Coatings: Wax, and corrosion-resistant paint. Coordinate with Architect.

J. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Chrome-plated steel, two piece, with 1-inch vertical adjustment.
2. Sidewall Mounting: Chrome-plated steel, one piece, flat.

K. Sprinkler Guards:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Reliable Automatic Sprinkler Co., Inc. (The).
   b. Tyco Fire & Building Products LP.
   c. Victaulic Company.

2. Standard: UL 199.

3. Type: Wire cage with fastening device for attaching to sprinkler.

2.11 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water-Motor-Operated Alarm:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Globe Fire Sprinkler Corporation.
   b. Tyco Fire & Building Products LP.
   c. Victaulic Company.

2. Standard: UL 753.

3. Type: Mechanically operated, with Pelton wheel.
4. Alarm Gong: Cast aluminum with red-enamel factory finish.
5. Size: 8-1/2-inches diameter.
6. Components: Shaft length, bearings, and sleeve to suit wall construction.
7. Inlet: NPS 3/4.
8. Outlet: NPS 1 drain connection.

C. Electrically Operated Alarm Bell:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fire-Lite Alarms, Inc.; a Honeywell International company.
b. Notifier.
c. Potter Electric Signal Company, LLC.

2. Standard: UL 464.

3. Type: Vibrating, metal alarm bell.
4. Finish: Red-enamel factory finish, suitable for outdoor use.
5. 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

D. Water-Flow Indicators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Potter Electric Signal Company, LLC.
b. Watts; a Watts Water Technologies company.

2. Standard: UL 346.

3. Water-Flow Detector: Electrically supervised.
4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
5. Type: Paddle operated.
6. Pressure Rating: 250 psig.
7. Design Installation: Horizontal or vertical.

E. Pressure Switches:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Potter Electric Signal Company, LLC.
b. Tyco Fire & Building Products LP.

2. Standard: UL 346.

3. Type: Electrically supervised water-flow switch with retard feature.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design Operation: Rising pressure signals water flow.

F. Valve Supervisory Switches:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fire-Lite Alarms, Inc.; a Honeywell International company.
b. Potter Electric Signal Company, LLC.

2. Standard: UL 346.

3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.
6. 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

2.12 MANUAL CONTROL STATIONS

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide" for hydraulic operation, with union, NPS 1/2 pipe nipple, and bronze ball valve.

B. Include metal enclosure labeled "MANUAL CONTROL STATION," with operating instructions and cover held closed by breakable strut to prevent accidental opening.

2.13 CONTROL PANELS

A. Description: Single-area, two-area, or single-area cross-zoned control panel as indicated, including NEMA ICS 6, Type 1 enclosure, detector, alarm, and solenoid-valve circuitry for operation of deluge valves.

1. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide" when used with thermal detectors and Class A detector circuit wiring.
2. Electrical characteristics are 120-V ac, 60 Hz, with 24-V dc rechargeable batteries.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application

B. Manual Control Stations: Electric operation, metal enclosure, labeled "MANUAL CONTROL STATION," with operating instructions and cover held closed by breakable strut to prevent accidental opening.

C. Manual Control Stations: Hydraulic operation, with union, NPS 1/2 pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION," with operating instructions and cover held closed by breakable strut to prevent accidental opening.

D. Panels Components:

1. Power supply.
2. Battery charger.
3. Standby batteries.
4. Field-wiring terminal strip.
5. Electrically supervised solenoid valves and polarized fire-alarm bell.
6. Lamp test facility.
7. Single-pole, double-throw auxiliary alarm contacts.
8. Rectifier.

2.14 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AGF Manufacturing Inc.
2. AMETEK, Inc.
3. Ashcroft Inc.

B. Standard: UL 393.

C. Dial Size: 3-1/2- to 4-1/2-inch diameter.

D. Pressure Gage Range: 0- to 250-psig minimum.

E. Label: Include "WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.2 SERVICE-ENTRANCE PIPING

A. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements for exterior piping in Section 211100 "Facility Fire-Suppression Water-Service Piping" for exterior piping.

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping. Comply with requirements for backflow preventers in Section 211100 "Facility Fire-Suppression Water-Service Piping." Coordinate with Civil Engineer.

C. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

3.3 WATER-SUPPLY CONNECTIONS

A. Connect sprinkler piping to building's interior water-distribution piping. Comply with requirements for interior piping in Section 221116 "Domestic Water Piping."

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-distribution piping. Comply with requirements for backflow preventers in Section 221119 "Domestic Water Piping Specialties."

C. Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

3.4 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.

C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 and smaller.

F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

J. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.

K. Install alarm devices in piping systems.

L. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13. In seismic-rated areas, refer to Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."

M. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they are not subject to freezing.

N. Fill sprinkler system piping with water.

O. Install electric heating cables and pipe insulation on sprinkler piping in areas subject to freezing.

P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

3.5 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.

I. Steel-Piping, Pressure-Sealed Joints: Join lightwall steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

J. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.

K. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

L. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

M. Steel-Piping, Pressure-Sealed Joints: Join Schedule 5 steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

N. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

O. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

P. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

3.6 INSTALLATION OF COVER SYSTEM FOR SPRINKLER PIPING

A. Install cover system, brackets, and cover components for sprinkler piping according to manufacturer's "Installation Manual" and NFPA 13 or NFPA 13R for supports.

3.7 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:

1. Install valves in vertical position for proper direction of flow, in main supply to system.
2. Install alarm valves with bypass check valve and retarding chamber drain-line connection.

3.8 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.

B. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

3.9 FIRE-DEPARTMENT CONNECTION INSTALLATION

A. Coordinate with AHJ and Civil Engineer to coordinate FDC type.

B. Install wall-type, fire-department connections.

C. Install freestanding, yard-type, fire-department connections in concrete slab support. Comply with requirements for concrete in Division 03 Section "Cast-in-Place Concrete.".
   1. Install protective pipe bollards around each fire-department connection. Comply with requirements for bollards in Division 05 Section "Metal Fabrications.".

D. Install automatic (ball drip) drain valve at each check valve for fire-department connection.

3.10 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.11 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

   1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
   4. Energize circuits to electrical equipment and devices.
   5. Coordinate with fire-alarm tests. Operate as required.
   6. Coordinate with fire-pump tests. Operate as required.
   7. Verify that equipment hose threads are same as local fire department equipment.

B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.12 CLEANING

A. Clean dirt and debris from sprinklers.

B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.13 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves and pressure-maintenance pumps.

3.14 PIPING SCHEDULE

A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends, cast-iron threaded fittings, and threaded grooved ends, grooved-end fittings, grooved-end-pipe couplings, and grooved joints.

B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.

C. Standard-pressure, wet-pipe sprinkler system shall be the following:
   1. NPS 2” and smaller: Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
   2. NPS 2-1/2 and larger: Standard-weight, black-steel pipe with grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

D. Paint exposed piping. Coordinate with Architect.

E. Provide 1” thick insulation with aluminum jacketing for exterior exposed piping. See section 230719 for requirements.

3.15 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:

   1. Rooms without Ceilings: Upright sprinklers.
   2. Rooms with Suspended Ceilings: Recessed sprinklers.
   3. Wall Mounting: Sidewall sprinklers.
   4. Spaces Subject to Freezing: Upright, pendent, dry sprinklers; and sidewall, dry sprinklers as indicated. Coordinate with Architect.
   5. Special Applications: Extended-coverage, flow-control, and quick-response sprinklers where indicated.

B. Provide sprinkler types in subparagraphs below with finishes indicated.

   1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
   2. Flush Sprinklers: Bright chrome, with painted white escutcheon.

3. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
4. Residential Sprinklers: Dull chrome.
5. Upright Pendent and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

C. Match finishes and paint colors with architectural elements. Request Architect for final approval on finishes

END OF SECTION 211313

SECTION 220010 – SUMMARY OF PLUMBING WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 22 Specification Sections, apply to this Section.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. The following Summary of Work is intended as an aid to achieve an understanding of the various elements of work included in the project, and is not intended to be all-inclusive. Detailed descriptions of work and requirements are given in drawings and specifications.

B. Contract Documents were prepared for the Project by:
Ethos Engineering,
119 West Van Buren, Suite 101
Harlingen, Texas 78550
Phone Number: (956) 230-3435

C. Scope of Work: Refer to drawings for a detailed Scope of Work.

1. Provide all materials and labor associated with new fully-operational plumbing systems for the project "Cameron County Appraisal District, New Building Addition and Renovation", including but not limited to the following:

a. Plumbing fixtures and appliances such as water closets, lavatories, faucets, drinking fountains, instantaneous and storage type electric domestic water heaters, floor drains, valves, fittings, hardware and specialties.
b. Potable water distribution piping and service connections to site utilities.
c. Sanitary waste water and vent piping and service line connections to site utilities.
d. Painting: See Division 9 specifications. Paint all exposed piping, insulation, hangers, accessories in interior exposed areas. Paint exterior pipe supports. Coordinate paint type, color and scope of work with Architect.

1.3 ALLOWANCES

A. See Division 0 Specifications.

1.4 COORDINATION

A. All plumbing work shall be done under sub-contract to a General Contractor. Plumbing Contractor shall coordinate all work through General Contractor, who is ultimately responsible for the entire project.

B. Prior to bidding, Plumbing Contractor shall coordinate all work in Division-22 for integration with civil work, mechanical work, electrical work, irrigation work and general construction. A detailed list of inclusion and exclusions shall be provided to General Contractors at least three

days prior to the end of the period set aside to request clarifications so that coordination of any missing items may be addressed and clarified by Architect/Engineer as needed.

1. Coordinate water line diameter, tap size, meter size and backflow preventer size with MEP Engineer. While meter size may be smaller, water line diameter, tap, backflow preventer sizes shall match or be larger than the connection sizes shown on Plumbing drawings. If the distance from the water mains is too large, upsize line, valve sizes to minimize pressure drops. Coordinate details with Engineer.

C. All electrical work required for operation of plumbing systems shall be coordinated through the General Contractor prior to bidding to ensure that all starters, disconnects, conduit and wiring are provided as part of the project. All components needed for a full operational installation of systems shall be provided.

D. All Building Automation Systems (BAS) required for operation of plumbing systems shall be coordinated through the General Contractor prior to bidding, to ensure that all equipment, materials, valves, sensors, devices and labor are provided as part of the project. All components needed for a full operational installation of systems shall be provided.

E. Plumbing Contractor shall coordinate and supervise installation of all controls systems, and coordinate with electrical contractors and equipment suppliers as needed. All components needed for a full operational installation of systems shall be provided.

F. Contractor shall coordinate with other divisions for power and control of plumbing systems. It is not the intent of this specification to dictate who will conduct work, only to state the requirements of conducting the work.

G. Cooperate fully with other contractors so that work under those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.

H. Coordinate with Div. 1 for work sequence and optimization of construction schedule.

I. Coordinate with Div. 21 for Fire Suppression System.

J. Coordinate with Div. 23 for Mechanical System.

K. Coordinate with Div. 26 electrical contractor for providing power to plumbing equipment, and for Fire Alarm Systems interface with plumbing systems.

L. Issue written notification of the following tasks and allow five (5) days for Engineer to respond and schedule an inspection as required. Failure to issue written notification may result in work having to be redone to allow for proper inspection. It is contractor's responsibility to make sure Engineer receives notification.

1. Upon completion of underground piping installation and prior to testing or covering up.
2. Upon completion of all water piping installation and prior to insulation and/or testing.
3. Upon completion of ductwork and prior to testing and insulating.
4. Above ceiling inspections prior to ceiling tile installation.
5. When ready to request manufacturer's start-up of each piece of equipment.
6. When ready for Substantial Completion Inspection.
7. When ready for Final Inspection.

M. General

1. The Contractor shall execute all work hereinafter specified or indicated on accompanying Drawings. Contractor shall provide all equipment necessary and usually furnished in connection with such work and systems whether or not mentioned specifically herein or on the Drawings.
2. The Contractor shall be responsible for fitting his material and apparatus into the building and shall carefully lay out his work at the site to conform to the structural conditions, to avoid all obstructions, to conform to the details of the installation and thereby to provide an integrated satisfactory operating installation.
3. The Mechanical, Electrical, Plumbing, and associated 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. These details are subject to the requirements of standards referenced elsewhere in these specifications, and 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.
4. When the mechanical, electrical and plumbing drawings do not give exact details as to the elevation of pipe, conduit and ducts, the Contractor shall physically arrange the systems to fit in the space available at the elevations intended with proper grades for the functioning of the system involved. Piping, exposed conduit and the 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.

1.5 WORK SEQUENCE

A. Locate Utilities:

1. Coordinate with power, water, sewer, telephone, communications, and other utilities as well as designated Owner's personnel to locate all utilities prior to digging in any area.
2. Obtain any approvals required from utilities to relocate utilities.
3. Cost of relocating or bypassing utilities indicated on drawings shall be included in Base Bid.

B. Coordinate with Division 1 requirements to optimize construction schedule.

C. Provide equipment and material submittals, coordination drawings and shop drawings as required by specifications.

D. Submit detailed plumbing Schedule of Values with Submittals. Plumbing Submittals will not be accepted without a detailed Schedule of Values.

E. Sequence construction in coordination with work by other disciplines.

1.6 CONTRACTOR USE OF PREMISES

A. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.

1. Driveways and Entrances: Keep driveways and entrances to construction site clear and available to other Contractors, Owner, and A/E personnel at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

B. Site Safety: Take every precaution to ensure the site does not present a threat to the safety of occupants and/or workers. Minimal safety requirements include, but are not limited to the following:

1. Temporary fencing around construction areas.
2. Yellow caution tape and construction barricades along open trenches during the day. Trenches shall be covered at night and warning lights provided on construction barricades.
3. Temporary fencing around equipment while site work is in progress.

1.7 SUBMITTALS

A. Manufacturer's standard dimensioned drawings, performance and product data shall be edited to delete reference to equipment, features, or information which is not applicable to the equipment being supplied for this project.

B. Provide all plumbing submittals at the same time in one or multiple bound volumes. Include originals from manufacturer. All submittals shall be in native pdf and searchable format. Faxes and copies of faxes are not acceptable.

C. Provide sufficient copies of approved data, with the engineer's approved stamp, for inclusion in the operations and maintenance manuals.

D. Provide detailed coordination drawings showing how plumbing system components will be installed in coordination with work by others. Engineer’s drawing files will be made available to Contractor for producing coordination and as-built drawings upon request.

1.8 SCHEDULE OF VALUES -Special Requirements

A. Plumbing Contractor shall submit a Schedule of Values reflecting the total value of Plumbing Work in the Contract, and broken down into the following items as a minimum, with a line-item for Materials/Equipment and another for Labor:

1. Plumbing fixtures and equipment
2. Plumbing materials
3. Plumbing labor
4. Allowances.
5. Miscellaneous
6. Administrative and project management.

B. Schedule of Values shall be included with bound submittals. Submittals without a Schedule of Values shall not be reviewed.

1.9 EQUIPMENT MANUFACTURERS

A. Plumbing design is based on equipment and materials scheduled and specified. These are used as the basis for performance characteristics, quality, and physical dimensions/weight.

B. Equipment and materials by other APPROVED manufacturers may be provided by Contractor. In doing so, Contractor assumes responsibility for the performance, quality, and physical dimensions of the proposed units.

C. Any costs associated with modifications to the design due to submittal of equipment and/or materials other than those used as the basis of design are the Contractor's responsibility. This includes any design time, production of drawings, and time delays.

D. Where use of equipment and/or materials other than those used as the basis of design impact other disciplines, Contractor shall assume responsibility for all costs associated with any APPROVED modifications. This may include resizing of electrical circuits, modifying openings in the structure, relocating floor drains, etc.

1.10 OPERATIONS AND MAINTENANCE MANUALS & TRAINING

A. Submit Operations and Maintenance Manuals two weeks prior to Substantial Completion Inspection. Engineer will not conduct a Substantial Completion Inspection without having reviewed Operations and Maintenance Manuals.

B. Use Operations and Maintenance Manuals as a guide for conducting training of Owner's personnel.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 220010

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 STACK-SLEEVE FITTINGS

A. Manufacturers:

1. Smith, Jay R. Mfg. Co.
2. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A. Manufacturers:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Metraflex Company (The).
4. Pipeline Seal and Insulator, Inc.
5. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

A. Manufacturers:

1. Presealed Systems.

B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
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.

2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Using grout, seal the space around outside of stack-sleeve fittings.

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade: Cast-iron wall sleeves

2. Exterior Concrete Walls below Grade: Cast-iron wall sleeves with sleeve-seal system.
   a. Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system

3. Concrete Slabs-on-Grade: Cast-iron wall sleeves with sleeve-seal system.
   a. Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade: Galvanized-steel-pipe sleeves

5. Interior Partitions: Galvanized-steel-pipe sleeves

END OF SECTION 220517

SECTION 220518 - ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

D. Split-Casting Brass Type: With polished, chrome-plated and rough-brass finish and with concealed hinge and setscrew.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Insulated Piping: One-piece, stamped-steel type.
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
e. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
f. Bare Piping in Equipment Rooms: One-piece, cast-brass type with rough-brass finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.
2. Existing Piping: Split-casting, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 220518

SECTION 220519 – METERS AND GAUGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Liquid-in-glass thermometers.
   2. Thermowells.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Certificates: For each type of meter and gauge, from manufacturer.

C. Operation and Maintenance Data: For meters and gauges to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
   1. Manufacturers:
      a. Trerice, H. O. Co.
      b. Weiss Instruments, Inc.
      c. Winters Instruments - U.S.

   2. Standard: ASME B40.200.

   3. Case: Cast aluminum; 9-inch nominal size unless otherwise indicated.
   4. Case Form: Adjustable angle unless otherwise indicated.
   5. Tube: Glass with magnifying lens and blue or red organic liquid.
   6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
   7. Window: Glass.
   8. Stem: Aluminum and of length to suit installation.

      a. Design for Air-Duct Installation: With ventilated shroud.
      b. Design for Thermowell Installation: Bare stem.

9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.2 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: brass.
4. Material for Use with Steel Piping: stainless steel.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. Bore: Diameter required to match thermometer bulb or stem.
7. Insertion Length: Length required to match thermometer bulb or stem.
8. Lagging Extension: Include on thermowells for insulated piping and tubing.
9. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.3 TEST PLUGS

A. Manufacturers

1. Flow Design, Inc.
2. Trerice, H. O. Co.
3. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
4. Weiss Instruments, Inc.

B. Description: Test-station fitting made for insertion into piping tee fitting.

C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

D. Thread Size: NPS ¼or NPS 1/2, ASME B1.20.1 pipe thread.

E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

F. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

2.4 TEST-PLUG KITS

A. Manufacturers:

1. Flow Design, Inc.
2. Trerice, H. O. Co.
3. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
4. Weiss Instruments, Inc.

B. Furnish one test-plug kit(s) containing one thermometer(s), one pressure gauge and adapter, and carrying case. Thermometer sensing elements, pressure gauge, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.

C. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch-diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F.

D. Pressure Gauge: Small, Bourdon-tube insertion type with 2- to 3-inch-diameter dial and probe. Dial range shall be at least 0 to 200 psig.

E. Carrying Case: Metal or plastic, with formed instrument padding.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install test plugs in piping tees.

G. Install thermometers in the following locations:
   1. Inlets and outlets of each domestic water heater.

3.2 CONNECTIONS

A. Install meters and gauges adjacent to machines and equipment to allow service and maintenance of meters, gauges, machines, and equipment.

3.3 ADJUSTING

A. Adjust faces of meters and gauges to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each domestic water heater shall be the following:
   1. Industrial-style, liquid-in-glass type.
   2. Test plug with EPDM self-sealing rubber inserts.

B. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Hot-Water Piping: 0 to 200 deg F.

END OF SECTION 22 05 19

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Bronze ball valves.
   2. Bronze gate valves.
   3. Bronze globe valves.

B. Related Sections:

   1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
   2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
2. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
2. Handwheel: For valves other than quarter-turn types.
3. Handlever: For quarter-turn valves NPS 6 and smaller.

4. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 5 plug valves, for each size square plug-valve head.

E. Valves in Insulated Piping: With 2-inchstem extensions and the following features:

1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

F. Valve-End Connections:
1. Solder Joint: With sockets according to ASME B16.18.
2. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE BALL VALVES

A. One-Piece, Reduced-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers:
   a. NIBCO INC.
   b. Watts Industries, Inc.; Water Products Div.
   c. Kitz Corporation
   d. Apollo

2. Description:

   a. Standard: MSS SP-110.
   b. CWP Rating: 400 psig.
   c. Body Design: One piece.
   d. Body Material: Bronze.
   e. Ends: Threaded.
   f. Seats: PTFE or TFE.
   g. Stem: Bronze.
   h. Ball: Chrome-plated brass.
   i. Port: Reduced.

2.3 BRONZE GATE VALVES

A. Class 150, Bronze Gate Valves:

1. Manufacturers:
   a. NIBCO INC.
   b. Hammond Valve.
   c. Kitz Corporation.
   d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   e. Apollo

2. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 300 psig.
c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron**, bronze, or aluminum**.

2.4 BRONZE GLOBE VALVES

A. Class 150, Bronze Globe Valves with Nonmetallic Disc:

1. Manufacturers:
a. Hammond Valve.
b. Milwaukee Valve Company.
c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
d. Kitz Corporation.
e. Apollo

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 300 psig.
c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: PTFE or TFE.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, or gate, or plug valves.
2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
3. Throttling Service: Globe or ball valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5and Larger: Flanged ends.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: One piece, regular port, bronze with bronze trim.
3. Bronze Gate Valves: Class 150.

4. Bronze Globe Valves: Class 150, bronze, nonmetallic disc.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron Ball Valves: Class 150.
3. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM seat, stainless-steel disc.
4. Iron Gate Valves: Class 250.
5. Iron Globe Valves: Class 250.

END OF SECTION 220523

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Pipe stands.
6. Equipment supports.

B. Related Sections:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 220516 "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
3. Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Fiberglass strut systems.
4. Pipe stands.
5. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:
1. Manufacturers:

    a. Allied Tube & Conduit.
    b. Cooper B-Line, Inc.
    c. Flex-Strut Inc.
    d. GS Metals Corp.
    e. Thomas & Betts Corporation.
    f. Unistrut Corporation; Tyco International, Ltd.
    g. Wesanco, Inc.

2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating: Hot-dipped galvanized.
8. Plastic Coating: PVC.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers:

1. Carpenter & Paterson, Inc.
2. Clement Support Services.
3. ERICO International Corporation.
4. National Pipe Hanger Corporation.
5. PHS Industries, Inc.
6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
7. Piping Technology & Products, Inc.
8. Rilco Manufacturing Co., Inc.
9. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, stainless- steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand:

1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
2. Base: Plastic.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: One or more; plastic.
3. Vertical Members: Two or more protective-coated-steel channels.

4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.7 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.8 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.9 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.

G. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

H. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

J. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

N. Insulated Piping:

1. Attach clamps and spacers to piping.

a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.

b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
b. NPS 4: 12 inches long and 0.06 inch thick.
c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099113 "Exterior Painting." Section 099123 "Interior Painting." Section 099600 "High-Performance Coatings."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use stainless-steel pipe hangers and attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
3. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
4. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
5. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
6. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.

3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.
13. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

Q. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

R. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 220548.13 - VIBRATION CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Elastomeric isolation pads.
2. Elastomeric isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Elastomeric hangers.
5. Spring hangers.

B. Related Requirements:

1. Section 210548.13 "Vibration Controls for Fire-Suppression Piping and Equipment" for devices for fire-suppression equipment and systems.
2. Section 230548.13 "Vibration Controls for HVAC" for devices for HVAC equipment and systems.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device type required.

B. Shop Drawings:

1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment.

C. Delegated-Design Submittal: For each vibration isolation device.

1. Include design calculations for selecting vibration isolators.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of vibration isolation device installation for plumbing piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ace Mountings Co., Inc.
2. Amber/Booth Company, Inc.
3. California Dynamics Corporation.
4. Isolation Technology, Inc.
5. Kinetics Noise Control.
6. Mason Industries.
7. Vibration Eliminator Co., Inc.
8. Vibration Isolation.
9. Vibration Mountings & Controls, Inc.

B. Elastomeric Isolation Pads:
1. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
2. Size: Factory or field cut to match requirements of supported equipment.
3. Pad Material: Oil and water resistant with elastomeric properties.
4. Surface Pattern: Ribbed, Waffle, non-slip pattern.
5. Infused nonwoven cotton or synthetic fibers.
6. Load-bearing metal plates adhered to pads.
7. Sandwich-Core Material: Resilient and elastomeric.

C. Double-Deflection, Elastomeric Isolation Mounts:
1. Mounting Plates:

a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded with threaded studs or bolts.
b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.

2. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

D. Restrained Elastomeric Isolation Mounts:
1. Description: All-directional isolator with restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.

a. Housing: Cast-ductile iron or welded steel.
b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

E. Freestanding, Laterally Stable, Open-Spring Isolators:
1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory-drilled steel plate for bolting to structure with an elastomeric isolator pad attached to the underside. Baseplates shall limit floor load to 500 psig.
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

F. Freestanding, Laterally Stable, Open-Spring Isolators in Two-Part Telescoping Housing:
1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators.

a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
b. Top housing with threaded mounting holes and internal leveling device, elastomeric pad.

G. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:
1. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
2. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

H. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

2.2 FACTORY FINISHES

A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static within specified loading limits.

3.3 VIBRATION CONTROL DEVICE INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete." Section 033053 "Miscellaneous Cast-in-Place Concrete."

B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

END OF SECTION 220548.13

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
3. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
4. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
5. Fasteners: Stainless-steel rivets or self-tapping screws.
6. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

C. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

D. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

E. Fasteners: Stainless-steel rivets or self-tapping screws.

F. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

G. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1/2 inch.

2.4 STENCILS

A. Stencils for Piping:

1. Lettering Size: Size letters according to ASME A13.1 for piping.
2. Stencil Paint: Exterior, gloss, alkyd enamel in colors complying with recommendations in ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.

2.5 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass beaded chain.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

A. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Safety yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Piping Color Coding: Painting of piping is specified in Section 099123 "Interior Painting." and Section 099600 "High-Performance Coatings."

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

a. Cold Water: 1-1/2 inches, round.
b. Hot Water: 1-1/2 inches, round.

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 220553

SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes insulating the following plumbing piping services:
   1. Domestic cold-water piping.
   2. Domestic hot-water piping.
   3. Domestic recirculating hot-water piping.
   4. Domestic chilled-water piping for drinking fountains.
   5. Supplies and drains for handicap-accessible lavatories and sinks.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
   2. Detail attachment and covering of heat tracing inside insulation.
   3. Detail insulation application at pipe expansion joints for each type of insulation.
   4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
   5. Detail removable insulation at piping specialties, equipment connections, and access panels.
   6. Detail application of field-applied jackets.
   7. Detail application at linkages of control devices.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
   2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

C. Comply with the following applicable standards and other requirements specified for miscellaneous components:
   1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
   1. Products:
      a. Armaflex
      b. K-Flex

G. Mineral-Fiber, Preformed Pipe Insulation:
   1. Products:
      a. Johns Manville; Micro-Lok.
      b. Knauf Insulation; 1000(Pipe Insulation.
      c. Owens Corning; Fiberglas Pipe Insulation.

   2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
   1. Products:
      a. Insulco, Division of MFS, Inc.; Triple I.
      b. P. K. Insulation Mfg. Co., Inc.; Super-Stik.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
   1. Products:

a. Foster Products Corporation, H. B. Fuller Company
b. Aeroflex
c. Armacell
d. K-Flex

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. Products:
a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.
2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. Products:
a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.
2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
1. Products:
a. Childers Products, Division of ITW; CP-35.
b. Foster Products Corporation, H. B. Fuller Company; 30-90.
c. ITW TACC, Division of Illinois Tool Works; CB-50.
d. Marathon Industries, Inc.; 590.

e. Mon-Eco Industries, Inc.; 55-40.
f. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

2.5 SEALANTS

A. Joint Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.
4. Color: White or gray.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. FSK and Metal Jacket Flashing Sealants:
1. Products:
a. Childers Products, Division of ITW; CP-76-8.
b. Foster Products Corporation, H. B. Fuller Company; 95-44.
c. Marathon Industries, Inc.; 405.
d. Mon-Eco Industries, Inc.; 44-05.
e. Vimasco Corporation; 750.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
1. Products:
a. Childers Products, Division of ITW; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
   1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in. for covering pipe and pipe fittings.

2.8 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..

2.9 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. Metal Jacket:

   1. Products:
      a. Childers Products, Division of ITW; Metal Jacketing Systems.
      b. PABCO Metals Corporation; Surefit.
      c. RPR Products, Inc.; Insul-Mate.

   2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
      a. Sheet and roll stock ready for shop or field sizing.
      b. Finish and thickness are indicated in field-applied jacket schedules.
      c. Moisture Barrier for Indoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper
      d. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
      e. Factory-Fabricated Fitting Covers:

         1) Same material, finish, and thickness as jacket.
         2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
         3) Tee covers.
         4) Flange and union covers.
         5) End caps.
         6) Beveled collars.
         7) Valve covers.
         8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

C. Underground Direct-Buried Jacket: 125-mil-thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.

2.10 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
   1. Products:
      a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
      b. Compac Corp.; 104 and 105.
      c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
      d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
   2. Width: 3 inches.
   3. Thickness: 11.5 mils.
   4. Adhesion: 90 ounces force/inch in width.
   5. Elongation: 2 percent.
   6. Tensile Strength: 40 lbf/inch in width.
   7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
   1. Products:
      a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
      b. Compac Corp.; 110 and 111.
      c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
      d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
   2. Width: 3 inches.
   3. Thickness: 6.5 mils.
   4. Adhesion: 90 ounces force/inch in width.
   5. Elongation: 2 percent.
   6. Tensile Strength: 40 lbf/inch in width.
   7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.11 SECUREMENTS

A. Bands:
   1. Products:
      a. Childers Products; Bands.
      b. PABCO Metals Corporation; Bands.
      c. RPR Products, Inc.; Bands.

   2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 316; 0.015 inch thick, 3/4 inch wide.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

C. Wire: 0.080-inch nickel-copper alloy.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers. Retain subparagraph and list of manufacturers below. See Section 016000 "Product Requirements."

1. Manufacturers:
    a. C & F Wire.
    b. Childers Products.
    c. PABCO Metals Corporation.
    d. RPR Products, Inc.

2.12 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:
    1. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures:
    1. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
    1. Verify that systems to be insulated have been tested and are free of defects.
    2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
    1. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
      a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
   1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:
   1. Pipe: Install insulation continuously through floor penetrations.
   2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
   1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
   2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
   3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
   4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
   5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
   6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
   7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
   8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and

unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed valve covers manufactured of same material as pipe insulation when available.
   2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   3. Install insulation to flanges as specified for flange insulation application.
   4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:
   1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
   2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
   3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
   4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
   1. Install preformed pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
   4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install preformed sections of same material as straight segments of pipe insulation when available.
   2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed sections of same material as straight segments of pipe insulation when available.
   2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
   3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   4. Install insulation to flanges as specified for flange insulation application.

3.8 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
   1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
   2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
   3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:
   1. Draw jacket material smooth and tight.
   2. Install lap or joint strips with same material as jacket.
   3. Secure jacket to insulation with manufacturer's recommended adhesive.
   4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
   5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.9 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
   1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
      a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
   1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of

flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.11 EQUIPMENT INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

B. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.

C. Domestic hot-water storage tank insulation shall be the following, of thickness to provide an R-value of 13: Mineral-fiber pipe and tank.

3.12 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.13 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water Piping embedded in walls:
1. All Pipe Sizes: Insulation shall be the following:
   a. Flexible Elastomeric: 1 inch thick, with two coats of protective coating recommended by the insulation manufacturer.

B. Domestic Hot and Recirculated Hot Water:
1. Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick, with two coats of protective coating recommended by the insulation manufacturer.

C. Condensate and Equipment Drain Water below 60 Deg F:
1. All Pipe Sizes: Insulation shall be the following:
   a. Flexible Elastomeric: 3/4 inch thick, with two coats of protective coating recommended by the insulation manufacturer.

D. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
1. All Pipe Sizes: Insulation shall be the following:
   a. Flexible Elastomeric: 1 inch thick.

E. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F:
   1. All Pipe Sizes: Insulation shall be the following:
      a. Flexible Elastomeric: 1 inch thick.

F. Hot Service Drains:
   1. All Pipe Sizes: Insulation shall be the following:
      a. Mineral-Fiber, Preformed Pipe, Type I or II: 1 inch thick.

G. Hot Service Vents:
   1. All Pipe Sizes: Insulation shall be the following:
      a. Mineral-Fiber, Preformed Pipe, Type I or II: 1 inch thick.

H. Vapor barrier on all piping, except on hot water piping.

I. Insulation shall be painted where exposed to view. Coordinate with Architect.

3.14 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Domestic Water Piping:
   1. All Pipe Sizes: Insulation shall be the following:
      a. Flexible Elastomeric: 1 inch thick.
      b. Vapor barrier.

3.15 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. Piping, Exposed:
   1. Aluminum, Smooth: 0.020 inch thick.

3.16 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 220719

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
2. Encasement for piping.

B. Related Requirements:

1. Section 221113 "Facility Water Distribution Piping" for water-service piping and water meters outside the building from source to the point where water-service piping enters the building.

1.3 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

1.4 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

1.5 FIELD CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of water service.
2. Do not interrupt water service without Architect's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

B. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

E. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

F. Copper Pressure-Seal-Joint Fittings:
1. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
2. Fittings for NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

G. Copper Push-on-Joint Fittings:
1. Description:

a. Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22.
b. Stainless-steel teeth and EPDM-rubber, O-ring seal in each end instead of solder-joint ends.

H. Copper-Tube, Extruded-Tee Connections:
1. Description: Tee formed in copper tube according to ASTM F 2014.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys.

D. Flux: ASTM B 813, water flushable.

E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 ENCASEMENT FOR PIPING

A. Standard: ASTM A 674 or AWWA C105/A21.5.

B. Form: tube.

2.5 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve-Type Transition Coupling: AWWA C219.

1. Manufacturers:

a. Cascade Waterworks Manufacturing.
b. Dresser, Inc.; Dresser Piping Specialties.
c. Ford Meter Box Company, Inc. (The).
d. JCM Industries.
e. Romac Industries, Inc.
f. Smith-Blair, Inc; a Sensus company.
g. Viking Johnson; c/o Mueller Co.

D. Plastic-to-Metal Transition Unions:

1. Manufacturers:

a. Charlotte Pipe and Foundry Company.
b. Harvel Plastics, Inc.
c. Spears Manufacturing Company.

2. Description:

a. PVC four-part union.
b. Brass threaded end.
c. Solvent-cement-joint plastic end.
d. Rubber O-ring.
e. Union nut.

2.6 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Manufacturers:

a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. EPCO Sales, Inc.
d. Hart Industries International, Inc.
e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
f. Zurn Plumbing Products Group; Wilkins Water Control Products.

2. Standard: ASSE 1079.
3. Pressure Rating: 150 psig.
4. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers:

a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. EPCO Sales, Inc.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Standard: ASSE 1079.
3. Factory-fabricated, bolted, companion-flange assembly.
4. Pressure Rating: 150 psig.
5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.

2. Nonconducting materials for field assembly of companion flanges.
3. Pressure Rating: 150 psig.
4. Gasket: Neoprene or phenolic.

5. Bolt Sleeves: Phenolic or polyethylene.
6. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

1. Manufacturers:

a. Perfection Corporation; a subsidiary of American Meter Company.
b. Precision Plumbing Products, Inc.
c. Victaulic Company.

2. Standard: IAPMO PS 66.
3. Electroplated steel nipple complying with ASTM F 1545.
4. Pressure Rating and Temperature: 300 psig at 225 deg F.
5. End Connections: Male threaded or grooved.
6. Lining: Inert and noncorrosive, propylene.

2.7 FLEXIBLE CONNECTORS

A. Manufacturers:

1. Flex-Hose Co., Inc.
2. Flex Pression, Ltd.
3. Flex-Weld, Inc.
4. Hyspan Precision Products, Inc.
5. Metraflex, Inc.
6. Universal Metal Hose; a Hyspan company

B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum **200 psig**
2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

D. Install underground copper tube in PE encasement according to ASTM A 674 or AWWA C105/A21.5.

E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."

F. Install shutoff valve immediately upstream of each dielectric fitting.

G. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."

H. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.

I. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

J. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

K. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

L. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

M. Install piping to permit valve servicing.

N. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

O. Install piping free of sags and bends.

P. Install fittings for changes in direction and branch connections.

Q. Install PEX piping with loop at each change of direction of more than 90 degrees.

R. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

S. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump.

T. Install thermostats in hot-water circulation piping.

U. Install thermometers on outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."

V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

F. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

G. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE INSTALLATION

A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.

B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.

C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."

1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.

D. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 and smaller and butterfly valves for piping NPS 2-1/2 and larger. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves.

E. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for calibrated balancing valves.

3.5 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
2. Fittings for NPS 2 and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.6 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

3.7 FLEXIBLE CONNECTOR INSTALLATION

A. Install flexible connectors in suction and discharge piping connections to each domestic water pump and in suction and discharge manifold connections to each domestic water booster pump.

B. Install bronze-hose flexible connectors in copper domestic water tubing.

C. Install stainless-steel-hose flexible connectors in steel domestic water piping.

3.8 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.
5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
6. NPS 6: 10 feet with 5/8-inch rod.
7. NPS 8: 10 feet with 3/4-inch rod.

F. Install supports for vertical copper tubing every 10 feet.

G. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.9 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.

3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.10 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

B. Label pressure piping with system operating pressure.

3.11 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source

and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.

f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.12 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

    a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.

    b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.13 CLEANING

A. Clean and disinfect domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.

    b. Fill and isolate system according to either of the following:

        1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.

        2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Repeat procedures if biological examination shows contamination.
e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Clean non-potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.14 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Under-building-slab, domestic water, building-service piping, up to NPS 8 and larger, shall be the following:

1. Soft copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.

E. Aboveground domestic water piping, NPS 2 and smaller, shall be the following:
1. Hard copper tube, ASTM B 88, Type L; copper, solder-joint fittings; and brazed joints.
2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.

F. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be the following:

1. Hard copper tube, ASTM B 88, Type L; copper, solder-joint fittings; and brazed joints.
2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
3. Hard copper tube, ASTM B 88, Type L; grooved-joint, copper-tube appurtenances; and grooved joints.

G. Aboveground, combined domestic water-service and fire-service-main piping, NPS 6 to NPS 12, shall be the following:

1. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.

3.15 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
3. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION 221116

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

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. Backflow preventers.
2. Outlet boxes.
3. Wall hydrants.
4. Water-hammer arresters.
5. Trap-seal primer valves.
6. Trap-seal primer systems.
7. Flexible connectors.

B. Related Requirements:

1. Section 220519 "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
2. Section 221116 "Domestic Water Piping" for water meters.
3. Section 223200 "Domestic Water Filtration Equipment" for water filters in domestic water piping.
4. Section 224300 "Medical Plumbing Fixtures" for thermostatic mixing valves for sitz baths, thermostatic mixing-valve assemblies for hydrotherapy equipment, and outlet boxes for dialysis equipment.
5. Section 224500 "Emergency Plumbing Fixtures" for water tempering equipment.
6. Section 224713 "Drinking Fountains" for water filters for water coolers.
7. Section 224716 "Pressure Water Coolers" for water filters for water coolers.
8. Section 224723 "Remote Water Coolers" for water filters for water coolers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For domestic water piping specialties.

1. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61 Annex G[**and NSF 14**].[**Mark "NSF-pw" on plastic piping components.**]

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: [**125 psig (860 kPa)**] unless otherwise indicated.

2.3 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

B. Manufacturers:
1. Zurn
2. Wilkins
3. Or Approved Equal.

C. Description:

1. Standard: ASSE 1013.
2. Operation: Continuous-pressure applications.
3. Pressure Loss: [**12 psig (83 kPa)]**
4. Size: see drawings.
5. Body: Bronze for NPS 2 (DN 50) and smalle
6. End Connections: Threaded for NPS 2 (DN 50) and smaller.
7. Configuration: Designed for [**horizontal, straight-through**] flow.
8. Accessories:

    a. Valves NPS 2 (DN 50) and Smaller: Ball type with threaded ends on inlet and outlet.
    b. Valves NPS 2-1/2 (DN 65) and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
    c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

2.4 OUTLET BOXES

A. Icemaker Outlet Boxes:

1. Manufacturers:
   a. Guy Gray
   b. Zurn
   c. Moen

2. Description: See schedule.

2.5 WALL HYDRANTS

1. Manufacturers:
   a. Zurn
   b. Woodford
   c. Or Approved Equal

2. Description: See schedule.

2.6 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Manufacturers:
   a. Zurn.
   b. Mifab.
   c. Or “Approved equal”.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: [Stainless Steel **Metal bellows**].
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.7 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device:

1. Manufacturers:
   a. PPP or Approved Equal
2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig (860 kPa) minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

2.8 FLEXIBLE CONNECTORS

A. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum [**200 psig (1380 kPa)**].
2. End Connections NPS 2 (DN 50) and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged steel nipple.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
3. Do not install bypass piping around backflow preventers.

B. Install outlet boxes recessed in wall or surface mounted on wall. Install 2-by-4-inch (38-by-89-mm) fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 061000 "Rough Carpentry."

C. Install water-hammer arresters in water piping according to PDI-WH 201.

D. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

3.2 CONNECTIONS

A. Comply with requirements for ground equipment in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Fire-retardant-treated-wood blocking is specified in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical connections.

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
1. Reduced-pressure-principle backflow preventers.
2. Outlet boxes.

3. Supply-type, trap-seal primer valves.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test each [**reduced-pressure-principle backflow preventer**] [**double-check, backflow-prevention assembly**] [**and**] [**double-check, detector-assembly backflow preventer**] according to authorities having jurisdiction and the device's reference standard.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 221119

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.
3. Encasement for underground metal piping.

B. Related Sections:

1. Section 221313 "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.

1.3 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For sovent drainage system. Include plans, elevations, sections, and details.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without Architect's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.

C. Heavy-Duty, Hubless-Piping Couplings:

a. Manufacturers:

1) ANACO.
2) Clamp-All Corp.
3) Ideal Div.; Stant Corp.
4) Mission Rubber Co.
5) Tyler Pipe; Soil Pipe Div.

2. Standards: ASTM C 1277 and ASTM C 1540.
3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.3 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

C. Adhesive Primer: ASTM F 656.

1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Solvent Cement: ASTM D 2564.

1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

3. Shielded, Nonpressure Transition Couplings:
   a. Standard: ASTM C 1460.
   b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

4. Pressure Transition Couplings:
   a. Standard: AWWA C219.
   b. Description: Metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
   c. Center-Sleeve Material: Stainless steel.
   d. Gasket Material: Natural or synthetic rubber.
   e. Metal Component Finish: Corrosion-resistant coating or material.

B. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric Unions:
   a. Description:

      1) Standard: ASSE 1079.
      2) Pressure Rating: 150 psig.
      3) End Connections: Solder-joint copper alloy and threaded ferrous.

3. Dielectric Flanges:
   a. Description:

      1) Standard: ASSE 1079.
      2) Factory-fabricated, bolted, companion-flange assembly.
      3) Pressure Rating: 150 psig.
      4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

4. Dielectric-Flange Insulating Kits:
   a. Description:

      1) Nonconducting materials for field assembly of companion flanges.
      2) Pressure Rating: 150 psig.
      3) Gasket: Neoprene or phenolic.
      4) Bolt Sleeves: Phenolic or polyethylene.
      5) Washers: Phenolic with steel backing washers.

5. Dielectric Nipples:
   a. Description:

      1) Standard: IAPMO PS 66
      2) Electroplated steel nipple.
      3) Pressure Rating: 300 psig at 225 deg F.
      4) End Connections: Male threaded or grooved.
      5) Lining: Inert and noncorrosive, propylene.

2.5 ENCASEMENT FOR UNDERGROUND METAL PIPING

A. Standard: ASTM A 674 or AWWA C105/A 21.5.

B. Material: high-density, cross-laminated polyethylene film of 0.004-inch minimum thickness.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. 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.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

K. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

L. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.

N. Install aboveground PVC piping according to ASTM D 2665.

O. Install underground PVC piping according to ASTM D 2321.

P. Install engineered soil and waste drainage and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
2. Sovent Drainage System: Comply with ASSE 1043 and sovent fitting manufacturer's written installation instructions.
3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

Q. Plumbing Specialties:
1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
2. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

R. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

B. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in OD's.
2. In Drainage Piping: Shielded, nonpressure transition couplings.
3. In Aboveground Force Main Piping: Fitting-type transition couplings.
4. In Underground Force Main Piping:

a. NPS 1-1/2 and Smaller: Fitting-type transition couplings.
b. NPS 2 and Larger: Pressure transition couplings.

B. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flange kits.
4. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Install individual, straight, horizontal piping runs:

a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

F. Install supports for vertical cast-iron soil piping every 15 feet.

G. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.

4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.

H. Install supports for vertical PVC piping every 48 inches.

I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Comply with requirements for cleanouts and drains specified in Section 221319 "Sanitary Waste Piping Specialties."
6. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.7 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.9 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

3.10 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

A. Underground and above ground (unless noted otherwise), soil, waste, and vent piping shall be the following:
   1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
   2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

B. In Return Air Plenum: Soil, waste, and vent piping shall be the following:
   1. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

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. Cleanouts.
   2. Floor drains.
   3. Roof flashing assemblies.
   4. Through-penetration firestop assemblies.
   5. Miscellaneous sanitary drainage piping specialties.
   6. Flashing materials.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. FOG: Fats, oils, and greases.

C. FRP: Fiberglass-reinforced plastic.

D. HDPE: High-density polyethylene plastic.

E. PE: Polyethylene plastic.

F. PP: Polypropylene plastic.

G. PVC: Polyvinyl chloride plastic.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for the following:

   1. Oil interceptors.

B. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.

   1. Wiring Diagrams: Power, signal, and control wiring.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

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.

C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.7 COORDINATION

A. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Metal Floor Cleanouts:

1. ASME A112.36.2M, Cast-Iron Cleanouts: see detail on plans.
2. Standard: ASME A112.36.2M for [**cast-iron soil pipe with cast-iron ferrule**] [**threaded, adjustable housing**] cleanout.
3. Size: Same as connected branch.
4. Type: [**Threaded, adjustable housing**].
5. Body or Ferrule: [**Cast iron**].
6. Clamping Device: [**Required**].
7. Outlet Connection: [**Threaded**].
8. Closure: [**Cast-iron plug**].
9. Adjustable Housing Material: [**Cast iron**] with [**threads**].
10. Frame and Cover Material and Finish: [**Nickel-bronze, copper alloy**]
11. Frame and Cover Shape: [**Round**].
12. Top Loading Classification: [**Medium**] Duty.

B. Plastic Wall Cleanouts:

1. See detail on plans.
2. Size: Same as connected branch.
3. Body: PVC.

4. Closure Plug: Stainless Steel.
5. Riser: Drainage pipe fitting and riser to cleanout of same material as drainage piping.

2.2 FLOOR DRAINS

A. Manufacturers:

1. Zurn.
2. Mifab.
3. Josam.

B. Description: See schedules.

2.3 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. Description: Manufactured assembly made of [**6.0-lb/sq. ft. (30-kg/sq. m)**, **0.0938-inch-(2.4-mm-)**] thick, lead flashing collar and skirt extending at least [**6 inches (150 mm)**] from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

   a. Open-Top Vent Cap: Without cap.
   b. Low-Silhouette Vent Cap: With vandal-proof vent cap.
   c. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.4 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

1. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
2. Size: Same as connected soil, waste, or vent stack.
3. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
4. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
5. Special Coating: Corrosion resistant on interior of fittings.

2.5 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Floor-Drain, Trap-Seal Primer Fittings <**Insert drawing designation if any**>:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.

2. Size: Same as floor drain outlet with NPS 1/2 (DN 15) side inlet.

B. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

C. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend [**1 inch (25 mm)**] [**2 inches (51 mm)**] <**Insert dimension**> above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

D. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

2.6 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft. (15-kg/sq. m), 0.0469-inch (1.2-mm) thickness.
3. Burning: 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness.

B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:

1. General Applications: 12 oz./sq. ft. (3.7 kg/sq. m or 0.41-mm thickness).
2. Vent Pipe Flashing: 8 oz./sq. ft. (2.5 kg/sq. m or 0.27-mm thickness).

C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch (1.01-mm) minimum thickness, unless otherwise indicated. Include G90 (Z275) hot-dip galvanized, mill-phosphatized finish for painting if indicated.

D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1.01-mm) minimum thickness.

E. Fasteners: Metal compatible with material and substrate being fastened.

F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

G. Solder: ASTM B 32, lead-free alloy.

H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
4. Locate at base of each vertical soil and waste stack.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

D. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

    a. Coordinate with Structural Drawings prior installation.
    b. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) total depression.
    c. Radius, 30 to 60 Inches (750 to 1500 mm): Equivalent to 1 percent slope.
    d. Radius, 60 Inches (1500 mm) or Larger: Equivalent to 1 percent slope, but not greater than 1-inch (25-mm) total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

E. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

F. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

G. Install through-penetration firestop assemblies in plastic [**conductors**] [**and**] [**stacks**] at floor penetrations.

H. Assemble open drain fittings and install with top of hub [**1 inch (25 mm)**] [**2 inches (51 mm)**] above floor.

I. Install deep-seal traps on floor drains and other waste outlets, if indicated.

J. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

K. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

L. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

M. Install vent caps on each vent pipe passing through roof.

N. Install oil interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.

O. Install wood-blocking reinforcement for wall-mounting-type specialties.

P. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Oil Interceptors: Connect inlet, outlet, vent, and gravity drawoff piping to unit; flow-control fitting and vent to unit inlet piping; and gravity drawoff and suction piping to oil storage tank.

D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness or thinner.
2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches (250 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Section 076200 "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Oil interceptors.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.6 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Commercial, electric, storage, domestic-water heaters.
   2. Flow-control, electric, tankless, domestic-water heaters.
   3. Domestic-water heater accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

   1. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of commercial and tankless, electric, domestic-water heater, from manufacturer.

B. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

C. Source quality-control reports.

D. Field quality-control reports.

E. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For electric, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects."

1.7 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Structural failures including storage tank and supports.
    b. Faulty operation of controls.
    c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.

    a. Commercial, Electric, Domestic-Water Booster Heaters:

        1) Controls and Other Components: Five years.

    b. Commercial, Electric, Storage, Domestic-Water Heaters:

        1) Storage Tank: Ten years.
        2) Controls and Other Components: Five years.

    c. Electric, Tankless, Domestic-Water Heaters: Five year(s).
    d. Compression Tanks: Ten years.

PART 2 - PRODUCTS

2.1 COMMERCIAL, ELECTRIC, DOMESTIC-WATER HEATERS

A. Commercial, Electric, Domestic-Water Heaters:

1. Commercial, Storage, Electric Water Heaters:
   a. Bradford White Co.
   b. State Industries.

2. Standard: UL 1453.
3. Tank Construction: ASME-code steel with 150-psig working-pressure rating..

   a. Tappings: Factory fabricated of materials compatible with tank for piping connections, relief valve, pressure gage, thermometer, drain, anode rod, and controls as required. Attach tappings to tank before testing and labeling. ASME B1.20.1 pipe thread.
   b. Interior Finish: Materials and thicknesses complying with NSF 61, barrier materials for potable-water tank linings. Extend finish into and through tank fittings and outlets.
   c. Insulation: Comply with ASHRAE 90.1. Surround entire storage tank except connections and controls.
   d. Jacket: Steel, with enameled finish.

4. Factory-Installed Tank Appurtenances:

   a. Anode Rod: Replaceable magnesium.
   b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
   c. Insulation: Comply with ASHRAE/IESNA 90.1.
   d. Jacket: Steel with enameled finish.
   e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
   f. Temperature Control: Adjustable thermostat.
   g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
   h. Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valve. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.
   i. Gages: Combination temperature-and-pressure type or separate thermometer and pressure gage.

5. Special Requirements: NSF 5 construction.

6. Capacity and Characteristics: See Drawings

2.2 ELECTRIC, TANKLESS, DOMESTIC-WATER HEATERS

A. Flow-Control, Electric, Tankless, Domestic-Water Heaters:

1. Manufacturers:

    a. Controlled Energy Corporation.
    b. Chronomite Laboratories, Inc.
    c. Eemax.
2. Standard: UL 499 for electric, tankless, (domestic-water heater) heating appliance.
3. Construction: Copper piping or tubing complying with NSF 61 Annex G barrier materials for potable water, without storage capacity.

    a. Connections: ASME B1.20.1 pipe thread.
    b. Pressure Rating: 150 psig.
    c. Heating Element: Resistance heating system.
    d. Temperature Control: Flow-control fitting.
    e. Safety Control: High-temperature-limit cutoff device or system.
    f. Jacket: Aluminum or steel with enameled finish or plastic.

4. Support: Bracket for wall mounting.
5. Capacity and Characteristics: See drawings.

2.3 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. AMTROL Inc.
    b. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
    c. State Industries.
    d. Taco, Inc.
2. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
3. Construction:

    a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
    b. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
    c. Air-Charging Valve: Factory installed.

4. Capacity and Characteristics: See drawings.

B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1.

D. Heat-Trap Fittings: ASHRAE 90.2.

E. Manifold Kits: Domestic-water heater manufacturer's factory-fabricated inlet and outlet piping for field installation, for multiple domestic-water heater installation. Include ball-, butterfly-, or gate-type shutoff valves to isolate each domestic-water heater and calibrated balancing valves to provide balanced flow through each domestic-water heater.

1. Comply with requirements for ball-, butterfly-, or gate-type shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."
2. Comply with requirements for balancing valves specified in Section 221119 "Domestic Water Piping Specialties."

F. Pressure-Reducing Valves: ASSE 1003 for water. Set at 25-psig-maximum outlet pressure unless otherwise indicated.

G. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

H. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than domestic-water heater working-pressure rating.

I. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.

J. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.

K. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Include dimension that will support bottom of domestic-water heater a minimum of 18 inches above the floor.

L. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

2.4 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on concrete base. Comply with requirements for concrete bases specified in Section 033000 "Cast-in-Place Concrete." Section 033053 "Miscellaneous Cast-in-Place Concrete."

1. Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
2. Maintain manufacturer's recommended clearances.
3. Arrange units so controls and devices that require servicing are accessible.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Install anchor bolts to elevations required for proper attachment to supported equipment.
8. Anchor domestic-water heaters to substrate.

B. Electric, Tankless, Domestic-Water Heater Mounting: Install electric, tankless, domestic-water heaters at least 18 inches above floor on wall bracket.

1. Maintain manufacturer's recommended clearances.
2. Arrange units so controls and devices that require servicing are accessible.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Anchor domestic-water heaters to substrate.

C. Install electric, domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."

D. Install commercial, electric, domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

E. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

F. Install combination temperature-and-pressure relief valves in water piping for electric, domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

G. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."

H. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers.

I. Assemble and install inlet and outlet piping manifold kits for multiple electric, domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each electric, domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each electric, domestic-water heater outlet. Comply with requirements for valves and thermometers.

J. Install pressure-reducing valve with integral bypass relief valve in electric, domestic-water booster-heater inlet piping and water hammer arrester in booster-heater outlet piping. Set pressure-reducing valve for outlet pressure of 25 psig. Comply with requirements for pressure-reducing valves and water hammer arresters specified in Section 221119 "Domestic Water Piping Specialties."

K. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.

L. Fill electric, domestic-water heaters with water.

M. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

C. Connect hot- and cold-water piping with shutoff valves and unions.

D. Make connections with dielectric fittings where piping is made of dissimilar metal.

E. Electrical Connections: Power wiring and disconnect switches are specified in Division 16 Sections. Arrange wiring to allow unit service.

F. Ground equipment.

1. 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 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain commercial and tankless, electric, domestic-water heaters.

END OF SECTION 223300

SECTION 224000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following conventional plumbing fixtures and related components:

1. Faucets for lavatories and sinks.
2. Flushometers.
3. Toilet seats.
4. Protective shielding guards.
5. Fixture supports.
6. Water closets.
7. Lavatories.
8. Kitchen sinks.
9. Service basins.

B. Related Sections include the following:

1. Division 10 Section "Toilet, Bath, and Laundry Accessories."
2. Division 22 Section "Domestic Water Piping Specialties" for backflow preventers, floor drains, and specialty fixtures not included in this Section.
3. Division 22 Section "Drinking Fountains and Water Coolers."
4. Division 31 Section "Facility Water Distribution Piping" for exterior plumbing fixtures and hydrants.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

C. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.

D. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.

E. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

F. FRP: Fiberglass-reinforced plastic.

G. PMMA: Polymethyl methacrylate (acrylic) plastic.

H. PVC: Polyvinyl chloride plastic.

I. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.4 SUBMITTALS

A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.

D. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

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.

C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.

D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
2. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
3. Stainless-Steel Commercial, Handwash Sinks: NSF 2 construction.
4. Vitreous-China Fixtures: ASME A112.19.2M.
5. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
6. Water-Closet, Flushometer Tank Trim: ASSE 1037.

H. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:

1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
4. Faucets: ASME A112.18.1.
5. Hose-Connection Vacuum Breakers: ASSE 1011.
6. Hose-Coupling Threads: ASME B1.20.7.
7. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
8. NSF Potable-Water Materials: NSF 61.
9. Pipe Threads: ASME B1.20.1.
10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
11. Supply Fittings: ASME A112.18.1.
12. Brass Waste Fittings: ASME A112.18.2.

I. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

1. Atmospheric Vacuum Breakers: ASSE 1001.
2. Brass and Copper Supplies: ASME A112.18.1.
3. Dishwasher Air-Gap Fittings: ASSE 1021.
4. Plastic Tubular Fittings: ASTM F 409.
5. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.

J. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Flexible Water Connectors: ASME A112.18.6.
2. Floor Drains: ASME A112.6.3.
3. Grab Bars: ASTM F 446.
4. Hose-Coupling Threads: ASME B1.20.7.
5. Off-Floor Fixture Supports: ASME A112.6.1M.
6. Pipe Threads: ASME B1.20.1.
7. Plastic Toilet Seats: ANSI Z124.5.
8. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 WARRANTY

A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace components of whirlpools that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures of unit shell.
b. Faulty operation of controls, blowers, pumps, heaters, and timers.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

PART 2 - PRODUCTS

2.1 LAVATORY FAUCETS

A. Lavatory Faucets:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

a. Chicago Faucets.
b. Elkay Manufacturing Co.
c. Moen, Inc.

2. Description: See plumbing schedule.

2.2 SINK FAUCETS

A. Sink Faucets:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

a. Chicago Faucets.
b. Elkay Manufacturing Co.
c. Moen, Inc.

2. Description: See plumbing schedule.

2.3 FLUSHOMETERS

A. Flushometers:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

a. Sloan Valve Company.
b. Zurn

2. Description: See plumbing schedule.

2.4 TOILET SEATS

A. Toilet Seats:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

a. American Standard Companies, Inc.
b. Bemis Manufacturing Company.
c. Kohler Co.

2. Description: See plumbing schedule.

2.5 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. TRUEBRO, Inc.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

2.6 FIXTURE SUPPORTS

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:

1. MIFAB Manufacturing Inc.
2. Zurn Plumbing Products Group; Specification Drainage Operation.

B. Water-Closet Supports:

1. Description: See plumbing schedule.

C. Urinals Supports:

1. Description: See plumbing schedule.

D. Lavatory Supports:

1. Description: See plumbing schedule.

E. Sink Supports:

1. Description: See plumbing schedule.

2.7 WATER CLOSETS

A. Water Closets:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

a. Crane Plumbing, L.L.C./Fiat Products.
b. American Standard Companies, Inc.
c. Zurn
d. Kohler
e. Toto USA.

2. Description: See plumbing schedule.

2.8 LAVATORIES

A. Lavatories:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

a. American Standard Companies, Inc.
b. Toto USA
c. Crane Plumbing, L.L.C./Fiat Products.

2. Description: See plumbing schedule.

2.9 KITCHEN SINKS

A. Kitchen Sinks:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

a. Elkay USA.
b. Willoughby.
c. Acorn.

2. Description: See plumbing schedule.

2.10 SERVICE BASINS

A. Mop Service Basin:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

a. American Standard Companies, Inc.
b. Toto USA
c. Crane Plumbing, L.L.C./Fiat Products.

2. Description: See plumbing schedule.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.

1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.

D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

E. Install wall-mounting fixtures with tubular waste piping attached to supports.

F. Install floor-mounting, back-outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.

G. Install counter-mounting fixtures in and attached to casework.

H. Install fixtures level and plumb according to roughing-in drawings.

I. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball, gate, or globe valves if supply stops are not specified with fixture. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

J. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

K. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

L. Install flushometer valves for accessible water closets with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

M. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.

N. Install toilet seats on water closets.

O. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

P. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.

Q. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

R. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

S. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Escutcheons for Plumbing Piping."

T. Set service basins in leveling bed of cement grout. Grout is specified in Division 22 Section "Common Work Results for Plumbing."

U. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

E. Install fresh batteries in sensor-operated mechanisms.

3.5 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Operate and adjust controls. Replace damaged and malfunctioning units and controls.

C. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.

D. Replace washers and seals of leaking and dripping faucets and stops.

E. Install fresh batteries in sensor-operated mechanisms.

3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224000

SECTION 224713 - DRINKING FOUNTAINS

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 drinking fountains and related components.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of drinking fountain.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   2. Include operating characteristics, and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For drinking fountains to include in maintenance manuals.

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.

B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" for fixtures for people with disabilities.

C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

D. ARI Standard: Comply with ARI's "Directory of Certified Drinking Water Coolers" for style classifications.

E. ARI Standard: Comply with ARI 1010, "Self-Contained, Mechanically Refrigerated Drinking-Water Coolers," for water coolers and with ARI's "Directory of Certified Drinking Water Coolers" for type and style classifications.

F. ASHRAE Standard: Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a refrigerant, unless otherwise indicated.

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. Filter Cartridges: Equal to 10 percent of amount installed for each type and size indicated, but no fewer than 3 of each.

PART 2 - PRODUCTS

2.1 DRINKING FOUNTAINS

A. Drinking Fountains: See Drawings for schedules and description.
   1. Manufacturers:
      a. Elkay Manufacturing Co.
      b. Oasis.
      c. Halsey Taylor
      d. Acorn Engineering Co.

2.2 FIXTURE SUPPORTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Josam Co.
   2. MIFAB Manufacturing, Inc.
   3. Zurn Plumbing Products Group; Specification Drainage Operation.

B. Description: ASME A112.6.1M, water cooler carriers. Include vertical, steel uprights with feet and tie rods and bearing plates with mounting studs matching fixture to be supported.
   1. Type I: Hanger-type carrier with two vertical uprights.
   2. Type II: Bilevel, hanger-type carrier with three vertical uprights.
   3. Supports for Accessible Fixtures: Include rectangular, vertical, steel uprights instead of steel pipe uprights.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.

B. Examine walls and floors for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.

B. Set pedestal drinking fountains on floor.

C. Install recessed drinking fountains secured to wood blocking in wall construction.

D. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.

E. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball or gate valve. Install valves in locations where they can be easily reached for operation.

F. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

G. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

H. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Install ball or gate shutoff valve on water supply to each fixture. Comply with valve requirements.

D. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

B. Adjust water cooler temperature settings.

3.5 FIELD QUALITY CONTROL

A. Water Cooler Testing: After electrical circuitry has been energized, test for compliance with requirements. Test and adjust controls and safeties.

1. Remove and replace malfunctioning units and retest as specified above.
2. Report test results in writing.

3.6 CLEANING

A. After installing fixtures, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

C. Provide protective covering for installed fixtures.

D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224713

SECTION 230010 – SUMMARY OF MECHANICAL WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 23 Specification Sections, apply to this Section.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. The following Summary of Work is intended as an aid to achieve an understanding of the various elements of work included in the project, and is not intended to be all-inclusive. Detailed descriptions of work and requirements are given in drawings and specifications.

B. Mechanical Contract Documents were prepared for the Project by:
Ethos Engineering,
119 West Van Buren, Suite 101
Harlingen, Texas 78550
Phone Number: (956) 230-3435

C. Scope of Work: Refer to drawings for a detailed Scope of Work.
1. Provide all materials and labor associated with new fully-operational mechanical and controls systems for the project "Cameron County Appraisal District, New Building and Renovation Project", including but not limited to the following:

2. Demolition Work:
   a. Remove HVAC equipment and materials as indicated. The Owner has right of first refusal. Dispose of equipment and materials that Owner no longer wishes to retain.
   b. Demolish existing hardware, controls, ductwork, air-devices, and accessories as indicated and that will no longer be needed.
   c. Patch roof as needed. Refer to Architectural drawings.

3. New Work: Provide all materials and labor associated with new fully-operational mechanical and controls systems, including but not limited to the following:
   a. Space conditioning packaged units on roof curbs, with direct-expansion cooling, staged compressors and variable fan speed, electric duct heaters, hot gas reheat, controls, and accessories for a complete and operational system. Provide full economizer control to meet IECC requirements.
   b. Building exhaust fans and associated louvers.
   c. Ductwork, diffusers, grilles, dynamic fire dampers, dampers, and other accessories.
   d. Testing, Adjusting, & Balancing (TAB) shall not be provided under the mechanical contract. General contractor to provide TAB.
   e. Controls: Coordinate with equipment supplier to provide fully integrated and operational controls, including unitary controllers, software, programmable thermostats, sensors, training, etc.
   f. Shop drawing submittals for all mechanical systems including but not limited to equipment, ductwork and piping.

g. Coordination drawings for placing of mechanical systems in relation to work by other disciplines.
h. Contractor is responsible for providing delegated design documents sealed by a PE, RTU installation to comply with IBC, and wind storm certification inspections and certifications for exterior mounted equipment. Contractor must notify Inspector prior to installing equipment, and apprise inspector of work scheduling involving equipment requiring wind inspection / certification, so that inspections may be carried out at required stage(s) of construction. Cost for inspection shall be borne by the Contractor. Inspector shall be certified by the Texas Department of Insurance (see www.tdi.state.tx.us for a list of certified Inspectors).
i. Coordinate electrical work with Div. 26 as required.
j. Coordinate fire alarm related work with Fire Alarm Contractor. Provide smoke detectors, wiring and controls for units, 2000 cfm and larger, where none exist.

4. Painting: See Division 9 specifications. Paint all exposed piping, ductwork, insulation, hangers, accessories in interior exposed areas. Paint exterior pipe supports. Coordinate paint type, color and scope of work with Architect.

1.3 ALLOWANCES

A. Allowances are included in the Division 1 specifications.

1.4 COORDINATION

A. All mechanical work shall be done under sub-contract to a General Contractor. Mechanical Contractor shall coordinate all work through General Contractor, who is ultimately responsible for the entire project.

B. Prior to bidding, Mechanical Contractor shall coordinate all work in Division-23 for integration with TAB, plumbing, electrical, controls work and general construction. A detailed list of inclusion and exclusions shall be provided to General Contractors at least three days prior to the end of the period set aside to request clarifications so that coordination of any missing items may be addressed and clarified by Architect/Engineer as needed.

C. All electrical work required for operation of mechanical systems shall be coordinated through the General Contractor prior to bidding to ensure that all starters, disconnects, VFD's, conduit and wiring are provided as part of the project. All components needed for a full operational installation of systems shall be provided.

D. All controls required for operation of mechanical systems shall be coordinated prior to bidding, to ensure that all equipment, materials, sensors, devices and labor are provided as part of the project. All components needed for a full operational installation of systems shall be provided. Mechanical Contractor shall coordinate and supervise installation of all controls systems.

E. All questions, requests for information, submittals, and correspondence from the Div. 23 Contractor shall be submitted via the General Contractor, who will forward to the Architect, who will then forward to the Engineer.

F. Div. 23 Contractor shall not make any changes to design without written authorization from the Engineer. If changes are requested by the Owner, Architect, General Contractor, Suppliers,

Manufacturers, or any others, Contractor should issue a written RFI for response by the Engineer.

G. Div. 23 Contractor shall issue seven days written notice prior to any activities that require the presence of the Engineer at the job-site. This applies to all inspections required by specifications, and particularly to those where work will be covered.

H. Cooperate fully with other contractors so that work under those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Ensure that systems are ready for controls and electrical connections when needed so as to not delay construction.

I. Contractor shall coordinate with other divisions for power and control of mechanical systems. It is not the intent of this specification to dictate who will conduct work, only to state the requirements of conducting the work.

J. Coordinate with Div. 1 for work sequence and optimization of construction schedule.

K. Coordinate with Div. 22 for Plumbing System.

L. Coordinate with Div. 26 electrical contractor for providing power to mechanical equipment, and for Fire Alarm Systems interface with mechanical systems.

M. Coordinate commissioning activities with Commissioning Authority.

N. Coordinate TAB activities with TAB Contractor.

O. Issue written notification of the following tasks and allow five (5) days for Engineer to respond and schedule an inspection as required. Failure to issue written notification may result in work having to be redone to allow for proper inspection. It is contractor's responsibility to make sure Engineer receives notification.
1. Upon completion of ductwork and prior to testing and insulating.
2. Metal duct leakage testing.
3. Above ceiling inspections prior to ceiling tile installation.
4. When ready to request manufacturer's start-up of each piece of equipment.
5. When ready for Systems Readiness Checklists (Commissioning).
6. When ready for Functional Performance testing (Commissioning).
7. When ready for an inspection by TAB contractor prior to developing detailed TAB Plan.
8. When ready to conduct complete Automation System software demonstration.
9. When ready for Substantial Completion Inspection.
10. When ready for Final Inspection.

P. General
1. The Contractor shall execute all work hereinafter specified or indicated on accompanying Drawings. Contractor shall provide all equipment necessary and usually furnished in connection with such work and systems whether or not mentioned specifically herein or on the Drawings.
2. The Contractor shall be responsible for fitting his material and apparatus into the building and shall carefully lay out his work at the site to conform to the structural conditions, to avoid all obstructions, to conform to the details of the installation and thereby to provide an integrated satisfactory operating installation.

3. The Mechanical, Electrical, Plumbing, and associated 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. These details are subject to the requirements of standards referenced elsewhere in these specifications, and 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.
4. When the mechanical, electrical and plumbing drawings do not give exact details as to the elevation of pipe, conduit and ducts, the Contractor shall physically arrange the systems to fit in the space available at the elevations intended with proper grades for the functioning of the system involved. Piping, exposed conduit and the 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.

1.5 WORK SEQUENCE

A. Locate Utilities:

1. Coordinate with power, water, sewer, telephone, communications, and other utilities as well as designated Owner's personnel to locate all utilities prior to digging in any area.
2. Obtain any approvals required from utilities to relocate utilities.
3. Cost of relocating or bypassing utilities indicated on drawings shall be included in Base Bid.
4. Where several new utilities must share a common area or path, coordinate with other trades so that the proper clearances are maintained and utilities may be installed in compliance with all requirements.
5. Refer to Civil Plans for coordination of connection points from site utilities to buildings.

B. Coordinate with Division 1 requirements to optimize construction schedule.

C. Provide equipment and material submittals, coordination drawings and shop drawings as required by specifications.

D. Submit detailed mechanical Schedule of Values with Submittals. Mechanical Submittals will not be accepted without a detailed Schedule of Values.

E. Sequence construction in coordination with work by other disciplines.

1.6 CONTRACTOR USE OF PREMISES

A. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.

1. Driveways and Entrances: Keep driveways and entrances to construction site clear and available to other Contractors, Owner, and A/E personnel at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

B. Site Safety: Take every precaution to ensure the site does not present a threat to the safety of occupants and/or workers. Minimal safety requirements include, but are not limited to the following:
1. Temporary fencing around construction areas.
2. Yellow caution tape and construction barricades along open trenches during the day. Trenches shall be covered at night and warning lights provided on construction barricades.
3. Temporary fencing around equipment while site work is in progress.

1.7 SUBMITTALS

A. Manufacturer's standard dimensioned drawings, performance and product data shall be edited to delete reference to equipment, features, or information which is not applicable to the equipment being supplied for this project.

B. Provide all mechanical submittals at the same time in one or multiple bound volumes. Include originals from manufacturer. All submittals shall be in native pdf and searchable format. Faxes and copies of faxes are not acceptable.

C. Provide sufficient copies of approved data, with the engineer's approved stamp, for inclusion in the operations and maintenance manuals.

D. Provide detailed coordination drawings showing how mechanical system components will be installed in coordination with work by others. Engineer’s drawing files will be made available to Contractor for producing coordination and as-built drawings upon request.

1.8 SCHEDULE OF VALUES -Special Requirements

A. Mechanical Contractor shall submit a Schedule of Values reflecting the total value of Mechanical Work in the Contract, and broken down into the following items as a minimum, with a line-item for Materials/Equipment and another for Labor:

MECHANICAL
1. HVAC equipment
2. HVAC materials (ductwork, piping, dampers)
3. HVAC labor
4. Controls equipment
5. Controls labor
6. Controls engineering and programming
7. Controls commissioning and closeout (minimum 10% of total controls cost)
8. Controls training (minimum 5% of total controls cost)
9. TAB
10. Commissioning related activities
11. Allowances.

12. Miscellaneous
13. Administrative and project management.

B. Schedule of Values shall be included with bound submittals. Submittals without a Schedule of Values shall not be reviewed.

1.9 EQUIPMENT MANUFACTURERS

A. Mechanical design is based on equipment and materials scheduled and specified. These are used as the basis for performance characteristics, quality, and physical dimensions/weight.

B. Equipment and materials by other APPROVED manufacturers may be provided by Contractor. In doing so, Contractor assumes responsibility for the performance, quality, and physical dimensions of the proposed units.

C. Any costs associated with modifications to the design due to submittal of equipment and/or materials other than those used as the basis of design are the Contractor's responsibility. This includes any design time, production of drawings, and time delays.

D. Where use of equipment and/or materials other than those used as the basis of design impact other disciplines, Contractor shall assume responsibility for all costs associated with any APPROVED modifications. This may include resizing of electrical circuits, modifying openings in the structure, relocating floor drains, etc.

1.10 OPERATIONS AND MAINTENANCE MANUALS & TRAINING

A. Submit Operations and Maintenance Manuals two weeks prior to Substantial Completion Inspection. Engineer will not conduct a Substantial Completion Inspection without having reviewed Operations and Maintenance Manuals.

B. Use Operations and Maintenance Manuals as a guide for conducting training of Owner's personnel.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 230010

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque. Unless otherwise noted, windings shall be:

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 HP shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

SECTION 230517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 STACK-SLEEVE FITTINGS

A. Manufacturers:

1. Smith, Jay R. Mfg. Co.
2. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A. Manufacturers:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Metraflex Company (The).
4. Pipeline Seal and Insulator, Inc.
5. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

A. Manufacturers:

1. Presealed Systems.

B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
   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.
   2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.
   1. Cut sleeves to length for mounting flush with both surfaces.
   2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
   3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.
   1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
   2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
   3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
   4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
   5. Using grout, seal the space around outside of stack-sleeve fittings.

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:
   1. Exterior Concrete Walls above Grade: Cast-iron wall sleeves.
   2. Exterior Concrete Walls below Grade: Cast-iron wall sleeves with sleeve-seal system. Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
   3. Concrete Slabs-on-Grade: Cast-iron wall sleeves with sleeve-seal system. Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
   4. Concrete Slabs above Grade: Galvanized-steel-pipe sleeves.
   5. Interior Partitions: Galvanized-steel-pipe sleeves.

END OF SECTION 230517

SECTION 230518 - ESCUTCHEONS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

D. Split-Casting Brass Type: With polished, chrome-plated and rough-brass finish and with concealed hinge and setscrew.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Insulated Piping: One-piece, stamped-steel type.
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
e. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
f. Bare Piping in Equipment Rooms: One-piece, cast-brass type with rough-brass finish.

2. Escutcheons for Existing Piping:
a. Insulated Piping: Split-plate, stamped-steel type with concealed hinge.
b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge.
d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge.
f. Bare Piping in Unfinished Service Spaces: Split-casting brass type with rough-brass finish.
g. Bare Piping in Equipment Rooms: Split-casting brass type with rough-brass finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
1. New Piping: One-piece, floor-plate type.
2. Existing Piping: Split-casting, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 230518

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Equipment supports.

B. Related Sections:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 230516 "Expansion Fittings and Loops for HVAC Piping" for pipe guides and anchors.
3. Section 230548.13 "Vibration Controls for HVAC" for vibration isolation devices.
4. Section 233113 "Metal Ducts" and Section 233116 "Nonmetal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Pipe stands.
4. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:
   1. Manufacturers:
      a. Allied Tube & Conduit.
      b. Cooper B-Line, Inc.
      c. Flex-Strut Inc.
      d. GS Metals Corp.
      e. Thomas & Betts Corporation.
      f. Unistrut Corporation; Tyco International, Ltd.
      g. Wesanco, Inc.
   2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
   3. Standard: MFMA-4.
   4. Channels: Continuous slotted steel channel with inturned lips.
   5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
   6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
   7. Metallic Coating: Hot-dipped galvanized.
   8. Paint Coating: Epoxy.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers:
   1. Carpenter & Paterson, Inc.
   2. ERICO/Michigan Hanger Co.
   3. PHS Industries, Inc.
   4. Pipe Shields, Inc.
   5. Rilco Manufacturing Company, Inc.
   6. Value Engineered Products, Inc.

B. Insulation-Insert Material for Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type, stainless- steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand:

1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
2. Base: Plastic.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: One or more; plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.7 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.8 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:
1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.

G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

N. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    b. NPS 4: 12 inches long and 0.06 inch thick.
    c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
    e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 Sections.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
3. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
4. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
5. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
6. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
7. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.
13. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.

2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

Q. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

SECTION 230548.13 - VIBRATION CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Elastomeric isolation pads.
2. Elastomeric isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Housed-restrained-spring isolators.
5. Elastomeric hangers.
6. Spring hangers.

B. Related Requirements:

1. Applies to Vibration Controls for Fire Suppression for devices for fire-suppression equipment and systems.
2. Applies to Vibration Controls for Plumbing for devices for plumbing equipment and systems.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device type required.

B. Shop Drawings:

1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated-Design Submittal: For each vibration isolation device.

1. Include design calculations for selecting vibration isolators and for designing vibration isolation bases.

D. Wind-Restraint Details:

1. Basic Wind Speed: Refer to Arch.
2. Building Classification Category: Refer to Arch.
3. Code recommended wind pressure multiplied by the maximum area of the HVAC component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.
4. Design Analysis: To support selection and arrangement of **wind** restraints. Include calculations of combined tensile and shear loads.
5.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of vibration isolation device installation for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.

B. Qualification Data: For testing agency.

C. Welding certificates.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Provide operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ace Mountings Co., Inc.
2. Amber/Booth Company, Inc.
3. California Dynamics Corporation.
4. Isolation Technology, Inc.
5. Kinetics Noise Control.
6. Mason Industries.
7. Vibration Eliminator Co., Inc.
8. Vibration Isolation.
9. Vibration Mountings & Controls, Inc.

B. Elastomeric Isolation Pads:
   1. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
   2. Size: Factory or field cut to match requirements of supported equipment.
   3. Pad Material: Oil and water resistant with elastomeric properties.
   4. Surface Pattern: Ribbed or Waffle pattern.
   5. Infused nonwoven cotton or synthetic fibers.
   6. Load-bearing metal plates adhered to pads.
   7. Sandwich-Core Material: Resilient and elastomeric.

      a. Surface Pattern: Ribbed or Waffle pattern.
      b. Infused nonwoven cotton or synthetic fibers.

C. Double-Deflection, Elastomeric Isolation Mounts:
   1. Mounting Plates:

      a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded.
      b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.

   2. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

D. Restrained Elastomeric Isolation Mounts
   1. Description: All-directional isolator with restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.

      a. Housing: Cast-ductile iron or welded steel.
      b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

E. Freestanding, Laterally Stable, Open-Spring Isolators:
   1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
   2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
   3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
   4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
   5. Baseplates: Factory-drilled steel plate for bolting to structure with an elastomeric isolator pad attached to the underside. Baseplates shall limit floor load to 500 psig.
   6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

F. Freestanding, Laterally Stable, Open-Spring Isolators with Vertical-Limit Stop Restraint:
   1. Housing: Steel housing with vertical-limit stops to prevent spring extension due to weight being removed.

      a. Base with holes for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
      b. Top plate with threaded mounting holes elastomeric pad.

c. Internal leveling bolt that acts as blocking during installation.

2. Restraint: Limit stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

G. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:
1. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
2. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

H. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:
1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

I. Steel Rails: Factory-fabricated, welded, structural-steel rails.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide rails.

a. Include supports for suction and discharge elbows for pumps.

2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Rails shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

J. Steel Bases: Factory-fabricated, welded, structural-steel bases and rails.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.

    a. Include supports for suction and discharge elbows for pumps.

2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

3.3 VIBRATION ISOLATION EQUIPMENT BASES INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Division 03 Sections.

3.4 VIBRATION-CONTROL AND WIND-RESTRAINT DEVICE INSTALLATION

A. Comply with requirements in Division 07 Section "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

B. Install cables so they do not bend across edges of adjacent equipment or building structure.

C. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

D. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

E. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

F. Drilled-in Anchors:
   1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
   2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
   3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
   4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
   5. Set anchors to manufacturer's recommended torque, using a torque wrench.
   6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.5 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust active height of spring isolators.

END OF SECTION 230548.13

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Duct labels.
5. Stencils.
6. Warning tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

2. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
3. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
4. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
5. Fasteners: Stainless-steel rivets or self-tapping screws.
6. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

C. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

D. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

E. Fasteners: Stainless-steel rivets or self-tapping screws.

F. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

G. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

2.4 DUCT LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

C. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

D. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

E. Fasteners: Stainless-steel rivets or self-tapping screws.

F. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

G. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings; also include duct size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions or as separate unit on each duct label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.5 WARNING TAGS

A. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Safety-yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Piping Color Coding: Painting of piping is specified in Division 09 Sections.

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.

7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

E. Pipe Label Color Schedule: Coordinate with Owner.

3.5 DUCT LABEL INSTALLATION

A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes: Coordinate with Owner.

B. Locate labels near points where ducts enter into and exit from concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

3.7 PAINTING

A. Clarification: In exposed areas (with no acoustic ceiling tiles), piping and piping insulation shall be painted. Although Division 9 may not specifically call for painting of MEP items, it states paint type and requirements for different materials. To extent possible coordinate painting with Division 9 and with Architect. Where adequate specifications are not available, use the following general guidelines:

1. Ferrous Metal: Semi-Gloss, Alkyd-Enamel Finish: 2 finish coats over an enamel undercoat and primer.
   a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils. S-W: Kem Kromik Universal Metal Primer B50NZ6/B50WZ1.
   b. Undercoat: Alkyd, interior enamel undercoat or semi-gloss, interior, alkyd-enamel finish coat, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils. S-W: Pro-mar 200 Interior Alkyd Enamel B34W200 Series.
   c. Finish Coat: Same as undercoat. Semi-gloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.
2. ASJ Jacket: Semi-Gloss, Acylic-Enamel Finish: 2 finish coats.
   a. Undercoat: Semi-gloss acrylic latex enamel applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 2.0 mils. S-W: Pro-Mar Interior Latex Egg-Shell Enamel B20W200.

b. Finish Coat: Same as undercoat. Semi-gloss, acrylic latex enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils

B. Final colors shall be coordinated with Owner and Architect during construction.

END OF SECTION 230553

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. TAB work shall not be contracted under Division 23 Contractor. Third party TAB Contractor shall be contracted by the Prime Contractor. Coordinate activities and assist TAB Contractor as needed.

B. Section Includes:

1. Balancing Air Systems:
   a. Constant-volume air systems.

2. Testing, Adjusting, and Balancing Equipment:
   a. Motors.
   b. Condensing units.
   c. Heat-transfer coils.

3. Testing, adjusting, and balancing existing systems and equipment.
4. Duct leakage tests.
5. Control system verification.
6. Other tests as specified.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. BAS: Building automation systems.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

1.4 PREINSTALLATION MEETINGS

A. TAB Conference: If requested by the Owner, conduct a TAB conference at Project site after approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.

1. Minimum Agenda Items:

    a. The Contract Documents examination report.
    b. The TAB plan.
    c. Needs for coordination and cooperation of trades and subcontractors.
    d. Proposed procedures for documentation and communication flow.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 60 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. System Readiness Checklists: Within 7 days of Contractor's Notice, submit system readiness checklists as specified in "Preparation" Article.

E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.

F. Certified TAB reports.

G. Sample report forms.

H. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.6 QUALITY ASSURANCE

A. TAB Specialists Qualifications: Certified by AABC.

1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.
2. TAB Technician: Employee of the TAB specialist and certified by AABC as a TAB technician.

B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.7 FIELD CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

J. Examine operating safety interlocks and controls on HVAC equipment.

K. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes the following:

1. Equipment and systems to be tested.
2. Strategies and step-by-step procedures for balancing the systems.
3. Instrumentation to be used.
4. Sample forms with specific identification for all equipment.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:

a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
b. Duct systems are complete with terminals installed.
c. Volume, smoke, and fire dampers are open and functional.
d. Clean filters are installed.
e. Fans are operating, free of vibration, and rotating in correct direction.
f. Variable-frequency controllers' startup is complete and safeties are verified.
g. Automatic temperature-control systems are operational.
h. Ceilings are installed.
i. Windows and doors are installed.
j. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation,"

Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.

c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.

2. Measure fan static pressures as follows:

a. Measure static pressure directly at the fan outlet or through the flexible connection.
b. Measure static pressure directly at the fan inlet or through the flexible connection.
c. Measure static pressure across each component that makes up the air-handling system.
d. Report artificial loading of filters at the time static pressures are measured.

3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
4. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.

1. Measure airflow of submain and branch ducts.
2. Adjust submain and branch duct volume dampers for specified airflow.
3. Re-measure each submain and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

D. Verify final system conditions.

1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust if necessary.
6. Measure and record all operating data.
7. Record final fan-performance data.

3.6 PROCEDURES FOR MOTORS

A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Phase and hertz.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter size and thermal-protection-element rating.
8. Service factor and frame size.

B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.7 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record fan and motor operating data.

3.8 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each electric heating coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

B. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.

3.9 TEMPERATURE TESTING

A. During testing, adjusting, and balancing, report need for adjustment in temperature regulation within the automatic temperature-control system.

B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of 2 successive 8-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.

C. Measure outside-air, wet- and dry-bulb temperatures.

D. Data may be trended using Building Automation System. However, calibration of DDC sensors must be verified prior to trending data.

3.10 PROCEDURES FOR SPACE PRESSURIZATION MEASUREMENTS AND ADJUSTMENTS

A. Before testing for space pressurization, observe the space to verify the integrity of the space boundaries. Verify that windows and doors are closed and applicable safing, gaskets, and sealants are installed. Report deficiencies and postpone testing until after the reported deficiencies are corrected.

B. Measure, adjust, and record the pressurization of each room, each zone, and each building by adjusting the supply, return, and exhaust airflows to achieve the indicated conditions.

C. Measure space pressure differential where pressure is used as the design criteria, and measure airflow differential where differential airflow is used as the design criteria for space pressurization.
   1. For pressure measurements, measure and record the pressure difference between the intended spaces at the door with all doors in the space closed. Record the high-pressure side, low-pressure side, and pressure difference between each adjacent space.
   2. For applications with cascading levels of space pressurization, begin in the most critical space and work to the least critical space.
   3. Test room pressurization first, then zones, and finish with building pressurization.

D. To achieve indicated pressurization, set the supply airflow to the indicated conditions and adjust the exhaust and return airflow to achieve the indicated pressure or airflow difference.

E. For spaces with pressurization being monitored and controlled automatically, observe and adjust the controls to achieve the desired set point.
   1. Compare the values of the measurements taken to the measured values of the control system instruments and report findings.
   2. Check the repeatability of the controls by successive tests designed to temporarily alter the ability to achieve space pressurization. Test overpressurization and underpressurization, and observe and report on the system's ability to revert to the set point.
   3. For spaces served by variable-air-volume supply and exhaust systems, measure space pressurization at indicated airflow and minimum airflow conditions.

F. In spaces that employ multiple modes of operation, such as normal mode and emergency mode or occupied mode and unoccupied mode, measure, adjust, and record data for each operating mode.

G. Record indicated conditions and corresponding initial and final measurements. Report deficiencies.

3.11 PROCEDURES FOR INDOOR-AIR QUALITY MEASUREMENTS

A. After air balancing is complete and with HVAC systems operating at indicated conditions, perform indoor-air quality testing.

B. Observe and record the following conditions for each HVAC system:
   1. The distance between the outside-air intake and the closest exhaust fan discharge, flue termination, or vent termination.
   2. Specified filters are installed. Check for leakage around filters.
   3. Cooling coil drain pans have a positive slope to drain.
   4. Cooling coil condensate drain trap maintains an air seal.
   5. Evidence of water damage.
   6. Insulation in contact with the supply, return, and outside air is dry and clean.

C. Measure and record indoor conditions served by each HVAC system. Make measurements at multiple locations served by the system if required to satisfy the following:
   1. Most remote area.
   2. One location per floor.
   3. One location for every 5000 sq. ft..

D. Measure and record the following indoor conditions for each location two times at two-hour intervals, and in accordance with ASHRAE 113:
   1. Temperature.
   2. Relative humidity.
   3. Air velocity.
   4. Concentration of carbon dioxide (ppm).

3.12 DUCT LEAKAGE TESTS

A. Witness the duct pressure testing performed by Installer.

B. Verify that proper test methods are used and that leakage rates are within specified tolerances.

C. Report deficiencies observed.

3.13 CONTROLS VERIFICATION

A. In conjunction with system balancing, perform the following:

   1. Verify temperature control system is operating within the design limitations.
   2. Confirm that the sequences of operation are in compliance with Contract Documents.
   3. Verify that controllers are calibrated and function as intended.
   4. Verify that controller set points are as indicated.
   5. Verify the operation of lockout or interlock systems.
   6. Verify the operation of valve and damper actuators.
   7. Verify that controlled devices are properly installed and connected to correct controller.
   8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.

9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.
10. Verify controls sequences for other MEP items as specified.

3.14 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.15 PROGRESS REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems balancing devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.16 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:
1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.

2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. VFD settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Duct, outlet, and inlet sizes.
3. Pipe and valve sizes and locations.
4. Terminal units.
5. Balancing stations.
6. Position of balancing devices.

E. RTU/Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Unit arrangement and class.

g. Discharge arrangement.
h. Sheave make, size in inches, and bore.
i. Center-to-center dimensions of sheave and amount of adjustments in inches.
j. Number, make, and size of belts.
k. Number, type, and size of filters.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Filter static-pressure differential in inches wg.
f. Cooling-coil static-pressure differential in inches wg.
g. Heating-coil static-pressure differential in inches wg.
h. Outdoor airflow in cfm.
i. Return airflow in cfm.
j. Outdoor-air damper position.
k. Return-air damper position.
l. Vortex damper position.

F. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Coil identification.
d. Capacity in Btu/h.
e. Number of stages.
f. Connected volts, phase, and hertz.
g. Rated amperage.
h. Airflow rate in cfm.
i. Face area in sq. ft..
j. Minimum face velocity in fpm.

2. Test Data (Indicated and Actual Values):

a. Heat output in Btu/h.
b. Airflow rate in cfm.
c. Air velocity in fpm.

d. Entering-air temperature in deg F.
e. Leaving-air temperature in deg F.
f. Voltage at each connection.
g. Amperage for each phase.

G. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

H. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft..
g. Indicated airflow rate in cfm.
h. Indicated velocity in fpm.
i. Actual airflow rate in cfm.
j. Actual average velocity in fpm.

k. Barometric pressure in psig.

I. Compressor and Condenser Reports: For refrigerant side of unitary systems, stand-alone refrigerant compressors, air-cooled condensing units, include the following:

1. Unit Data:
   a. Unit identification.
   b. Location.
   c. Unit make and model number.
   d. Compressor make.
   e. Compressor model and serial numbers.
   f. Refrigerant weight in lb.
   g. Low ambient temperature cutoff in deg F.

2. Test Data (Indicated and Actual Values):
   a. Inlet-duct static pressure in inches wg.
   b. Outlet-duct static pressure in inches wg.
   c. Entering-air, dry-bulb temperature in deg F.
   d. Leaving-air, dry-bulb temperature in deg F.
   e. Control settings.
   f. Unloader set points.
   g. Low-pressure-cutout set point in psig.
   h. High-pressure-cutout set point in psig.
   i. Suction pressure in psig.
   j. Suction temperature in deg F.
   k. Condenser refrigerant pressure in psig.
   l. Condenser refrigerant temperature in deg F.
   m. Oil pressure in psig.
   n. Oil temperature in deg F.
   o. Voltage at each connection.
   p. Amperage for each phase.
   q. Kilowatt input.
   r. Crankcase heater kilowatt.
   s. Number of fans.
   t. Condenser fan rpm.
   u. Condenser fan airflow rate in cfm.
   v. Condenser fan motor make, frame size, rpm, and horsepower.
   w. Condenser fan motor voltage at each connection.
   x. Condenser fan motor amperage for each phase.

J. Indoor-Air Quality Measurement Reports for Each HVAC System:
1. HVAC system designation.
2. Date and time of test.
3. Outdoor temperature, relative humidity, wind speed, and wind direction at start of test.
4. Room number or similar description for each location.
5. Measurements at each location.
6. Observed deficiencies.

K. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.17 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Architect.

B. Architect shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

E. If TAB work fails, proceed as follows:

1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
3. If the second verification also fails, design professional may contact AABC Headquarters regarding the AABC National Performance Guaranty.

F. Prepare test and inspection reports.

3.18 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 230713 - DUCT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply and outdoor air.
2. Indoor, concealed return located in unconditioned space.

B. Related Sections:
1. Section 230719 "HVAC Piping Insulation."
2. Section 233113 "Metal Ducts" for duct liners.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
3. Detail application of field-applied jackets.
4. Detail application at linkages of control devices.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, and are limited to, the following:
   1. Mineral-Fiber Insulation:
      a. CertainTeed
      b. Manson.
      c. Knauf FiberGlass GmbH.
      d. Owens-Corning Fiberglas Corp.
      e. Schuller International, Inc.

2.2 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type II for sheet materials.

G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
3. Service Temperature Range: 0 to plus 180 deg F.
4. Color: White.

2.6 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.8 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

2.9 TAPES

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
1. Width: 4 inches.
2. Thickness: 6.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.

6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.10 SECUREMENTS

A. Bands:

1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated.

2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
   a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

D. Wire: 0.062-inch soft-annealed, stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Section 078413 "Penetration Firestopping" and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.6 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.7 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 9.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

C. Do not field paint aluminum or stainless-steel jackets.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned space.
5. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
6. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
7. Outdoor, concealed supply and return.
8. Outdoor, exposed supply and return.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.

3.10 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Service: Round & rectangular, supply-air ducts concealed, including DOAS supply air ducts.
1. Material: Mineral-fiber blanket.
2. Thickness: 3 inches (R-8 min).
3. Number of Layers: One.
4. Field-Applied Jacket: Foil and paper.
5. Vapor Retarder Required: Yes.

B. Service: Round & rectangular, return, outside-air and fume hood exhaust ducts concealed.
1. Material: Mineral-fiber blanket.
2. Thickness: 2 inches (R-6 min).
3. Number of Layers: One.
4. Field-Applied Jacket: Foil and paper.
5. Vapor Retarder Required: Yes.

C. Service: Ten feet of supply and return air ducts closest to AHU or FCU.

1. Material: In addition to exterior wrap, provide internal liner for sound attenuation purposes.
2. Thickness: 1 inches.

D. Service: Ten feet of exhaust air duct closest to where duct penetrates the exterior envelope.
1. Material: Exterior wrap.
2. Thickness: 2 inches.

E. Where ductwork is not completely concealed, paint all ductwork and insulation. Coordinate color and finish with Architect.

END OF SECTION 230713

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 insulating the following HVAC piping systems:
   1. Condensate drain piping, indoors.

B. Related Sections:
   1. Section 230713 "Duct Insulation."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
   2. Detail attachment and covering of heat tracing inside insulation.
   3. Detail insulation application at pipe expansion joints for each type of insulation.
   4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
   5. Detail removable insulation at piping specialties.
   6. Detail application of field-applied jackets.
   7. Detail application at linkages of control devices.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
   2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Flexible Elastomeric Thermal Insulation:
      a. Aeroflex USA Inc.; Aerocel.
      b. Armacell LLC; AP Armaflex.
      c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

2.2 INSULATION MATERIALS

A. Mineral-fiber insulation will NOT be allowed for use on any cold piping systems.

B. Mineral-fiber wrap is NOT approved for use on piping insulation.

C. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

D. Products shall not contain asbestos, lead, mercury, or mercury compounds.

E. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

F. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

G. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

H. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
   1. Products:
      a. Aeroflex USA Inc.; Aeroseal.
      b. Armacell LCC; 520 Adhesive.
      c. Foster Products Corporation, H. B. Fuller Company; 85-75.
      d. RBX Corporation; Rubatex Contact Adhesive.

   2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
   1. Products:
      a. Childers Products, Division of ITW; CP-82.
      b. Foster Products Corporation, H. B. Fuller Company; 85-20.
      c. ITW TACC, Division of Illinois Tool Works; S-90/80.
      d. Marathon Industries, Inc.; 225.
      e. Mon-Eco Industries, Inc.; 22-25.

   2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
   1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
   1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
   3. Service Temperature Range: 0 to plus 180 deg F.
   4. Color: White.

2.6 SEALANTS

A. Joint Sealants:
   1. Materials shall be compatible with insulation materials, jackets, and substrates.
   2. Permanently flexible, elastomeric sealant.
   3. Service Temperature Range: Minus 100 to plus 300 deg F.
   4. Color: White or gray.
   5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. FSK and Metal Jacket Flashing Sealants:
   1. Materials shall be compatible with insulation materials, jackets, and substrates.
   2. Fire- and water-resistant, flexible, elastomeric sealant.
   3. Service Temperature Range: Minus 40 to plus 250 deg F.
   4. Color: Aluminum.
   5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. ASJ Flashing Sealants, Jacket Flashing Sealants:
   1. Materials shall be compatible with insulation materials, jackets, and substrates.
   2. Fire- and water-resistant, flexible, elastomeric sealant.
   3. Service Temperature Range: Minus 40 to plus 250 deg F.
   4. Color: White.
   5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
   1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
   2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.8 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in. for covering pipe and pipe fittings.

2.9 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..

2.10 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. Metal Jacket:
   1. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
      a. Factory cut and rolled to size.
      b. Finish and thickness are indicated in field-applied jacket schedules.
      c. Moisture Barrier: 3-mil-thick, heat-bonded polyethylene and kraft paper.
      d. Factory-Fabricated Fitting Covers:
         1) Same material, finish, and thickness as jacket.
         2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
         3) Tee covers.
         4) Flange and union covers.
         5) End caps.
         6) Beveled collars.
         7) Valve covers.
         8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

D. Underground Direct-Buried Jacket: 125-mil-thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.

2.11 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
   1. Width: 3 inches.
   2. Thickness: 11.5 mils.
   3. Adhesion: 90 ounces force/inch in width.
   4. Elongation: 2 percent.
   5. Tensile Strength: 40 lbf/inch in width.
   6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
   1. Width: 3 inches.
   2. Thickness: 6.5 mils.
   3. Adhesion: 90 ounces force/inch in width.
   4. Elongation: 2 percent.
   5. Tensile Strength: 40 lbf/inch in width.
   6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
   1. Width: 2 inches.
   2. Thickness: 3.7 mils.
   3. Adhesion: 100 ounces force/inch in width.
   4. Elongation: 5 percent.
   5. Tensile Strength: 34 lbf/inch in width.

2.12 SECUREMENTS

A. Bands:
   1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
   1. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range. **NO EXCEPTION: PIPES SHALL BE PAINTED.**

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
    a. For below-ambient services, apply vapor-barrier mastic over staples.
4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt

each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe

insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:
   1. Install pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
   4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install mitered sections of pipe insulation.
   2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed valve covers manufactured of same material as pipe insulation when available.
   2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   3. Install insulation to flanges as specified for flange insulation application.
   4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 07 Section "Penetration Firestopping."

3.8 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
   1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
   2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
   3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:
   1. Draw jacket material smooth and tight.
   2. Install lap or joint strips with same material as jacket.
   3. Secure jacket to insulation with manufacturer's recommended adhesive.
   4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
   5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.9 FINISHES

A. Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 9 Sections.
   1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
      a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
   1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of fittings, two locations of strainers, three locations of valves, for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.11 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
   1. Drainage piping located in crawl spaces.
   2. Underground piping.
   3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.12 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F:
   1. All Pipe Sizes: Insulation shall be the following:
      a. Flexible Elastomeric: 3/4 inch thick.
      b. Vapor Retarder Required: Yes.
      c. Finish: Painted (Coordinate with Architect).

3.13 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

3.14 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
   1. Aluminum, Smooth with Z-Shaped Locking Seam: 0.020 inch thick.

3.15 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 230719

SECTION 230800 - COMMISSIONING OF HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes commissioning process requirements for the following MEP systems, assemblies, and equipment:
   1. HVAC equipment.
   2. Controls and instrumentation, including BAS energy monitoring and control system.

B. Related Requirements:
   1. Section 019113 "General Commissioning Requirements" for general commissioning process requirements and Commissioning Coordinator responsibilities.

1.3 DEFINITIONS

A. Refer to Section 019113 "General Commissioning Requirements" for additional definitions and assignment of responsibilities.

1.4 CONTRACTOR'S RESPONSIBILITIES

A. Refer to Section 019113 "General Commissioning Requirements".

B. Perform commissioning tests at the direction of the CxA.

C. Attend construction phase controls coordination meeting.

D. Attend testing, adjusting, and balancing review and coordination meeting.

E. Participate in mechanical systems, assemblies, equipment, and component maintenance orientation and inspection.

F. Provide information requested by the CxA for final commissioning documentation.

G. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for required test period.

H. Provide Project-specific construction checklists and commissioning process test procedures for actual mechanical systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.

I. Direct and coordinate commissioning testing among subcontractors, suppliers, and vendors.

J. Verify testing, adjusting, and balancing of Work are complete.

K. Provide test data, inspection reports, and certificates in Systems Manual.

1.5 COMMISSIONING DOCUMENTATION

A. Provide the following information to the CxA for inclusion in the commissioning plan:
   1. Plan for delivery and review of systems manuals, and other documents and reports.
   2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
   3. Process and schedule for completing construction checklists and manufacturer's pre-start and startup checklists for mechanical systems, assemblies, equipment, and components to be verified and tested.
   4. Certificate of completion certifying that installation, pre-start checks, and startup procedures have been completed.
   5. Certificate of readiness certifying that mechanical systems, subsystems, equipment, and associated controls are ready for testing.
   6. Test and inspection reports and certificates.
   7. Corrective action documents.
   8. Verification of testing, adjusting, and balancing reports.

1.6 INFORMATIONAL SUBMITTALS

A. Construction Checklists: See related Sections for technical requirements, and generate construction checklists for the following:
   1. Instrumentation and control for MEP systems.
   2. Fans, rooftop air-handling units.

B. Certificates of readiness.

C. Certificates of completion of installation, pre-start, and startup activities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Refer to Section 019113 "General Commissioning Requirements".

3.2 SYSTEMS READINESS CHECKLISTS

A. Construction Checklists: Assist CxA in the preparation of detailed Systems Readiness checklists for systems, subsystems, equipment, and components.
   1. Contributors to the development of checklists shall include, but are not limited to:
      a. Systems and equipment installers.

b. TAB technicians.
c. Instrumentation and controls installers.

B. Contractor shall conduct Systems Readiness Testing to document compliance with installation and Systems Readiness checklists prepared by Commissioning Authority for Division-23 items.

C. Refer to Section 019113 "General Commissioning Requirements" for issues relating to Systems Readiness checklists and testing, description of process, details on non-conformance issues relating to pre-functional checklists and test.

3.3 SYSTEM START-UP

A. Contractor is solely responsible for system start-up. CxA may, at his discretion, witness start up procedures, but will not perform any Functional Testing of systems until Contractor has completed start-up and resolved all operating deficiencies.

3.4 TESTING PREPARATION

A. Certify that systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify that instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents and approved Shop Drawings and submittals, and that pretest set points have been recorded.

C. Certify that TAB procedures have been completed and that TAB reports have been submitted, discrepancies corrected, and corrective work approved.

D. Set systems, subsystems, and equipment into operating mode to be tested according to approved test procedures (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

3.5 TESTING AND BALANCING VERIFICATION

A. Prior to performance of testing and balancing Work, provide copies of reports, sample forms, checklists, and certificates to the CxA.

B. Provide technicians, instrumentation, and tools to verify testing and balancing of mechanical systems at the direction of the CxA.
1. The CxA will notify Contractor 4 days in advance of the date of field verification. Notice will not include data points to be verified.
2. The testing and balancing Subcontractor shall use the same instruments (by model and serial number) that were used when original data were collected.
3. Failure of an item includes a deviation of more than 10 percent. Failure of more than 10 percent of selected items shall result in rejection of final testing, adjusting, and balancing report.
4. Remedy deficiency and notify CxA so verification of failed portions can be performed.

3.6 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.

B. Scope of mechanical testing shall include entire HVAC installation, from equipment through distribution systems to each space served. Testing shall include measuring capacities and effectiveness of operational and control functions.

C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

D. Tests will be performed using design conditions whenever possible.

E. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the Contracting Officer and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

F. The CxA may direct that set points be altered when simulating conditions is not practical.

G. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

H. If tests cannot be completed because of a deficiency outside the scope of the mechanical system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

I. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.7 GENERAL TESTING PROCEDURES FOR HVAC SYSTEMS, SUBSYSTEMS, AND EQUIPMENT

A. HVAC Instrumentation and Control System Testing: Contractor shall fully test operation of controls system prior to requesting Functional Testing with CxA. Point-to-point check out sheets and as-built control diagrams shall be provided to CxA so he may develop testing procedures.

B. HVAC Distribution System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of air distribution systems; special exhaust; and other distribution systems, including HVAC terminal equipment and unitary equipment.

3.8 FUNCTIONAL TEST PROCEDURES FOR SYSTEMS TO BE COMMISSIONED

A. General

1. The following paragraphs outline the functional test procedures for the various Div. 23 items to be commissioned. Functional testing will take place only after System Readiness

checklists have been completed, equipment has been started-up, TAB has been verified, and Contractor has certified that systems are ready for functional testing.

2. All systems controlled via the Building Automation System shall have all control points and sequences tested by Controls Contractor prior to requesting testing by CX Authority.
3. Functional testing of HVAC systems shall include testing of the BAS.

B. All Equipment:
1. Verify nameplate information (serial numbers, model numbers, etc.); verify that equipment capacity is in accordance with requirements of construction documents.
2. Verify unit runs smoothly and quietly.
3. Verify operation of safeties.
4. Verify electrical wiring and grounding is correct.
5. Verify maintenance and NEC clearances are maintained.
6. Verify Systems Readiness Checklists have been completed.

3.9 COMMISSIONING TESTS

A. Functional testing will be performed on all HVAC equipment, including but limited to the following:
1. RTUs
2. DOAS
3. FCUs
4. Split VRF systems
5. Exhaust fans
6. Air distribution system
7. Building automation system

B. Sample requirements are as follows:
1. Record temperatures, pressures.
2. Record programmed setpoints (unocc/occ temperature, RH, CO2, runtime, safeties, alarms).
3. Record programmed schedules and interlocks.
4. Verify equipment installation
5. Verify equipment operation.
6. Verify electrical voltage and amperages are within tolerance.
7. Verify unit data in TAB report.
8. Verify alarms and safeties.
9. Verify all sequences.
10. Verify setpoint resets, adaptive controls for energy conservation.

C. Customized system readiness checklists and function testing requirements will be released after the submittal review phase.

3.10 TRAINING AND O&M MANUALS

A. Refer to Div. 23 specifications.

END OF SECTION 230800

SECTION 230993 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Related Sections include Division 23 Section "Packaged, Outdoor, Central-Station Air-Handling Units" for equipment controls requirements.

1.2 SUMMARY

A. This Section includes control sequences for HVAC systems, and equipment. Provide controls and operating sequences for the following HVAC systems at **CC Appraisal District**:
1. RTUS controlled by solid state controller integral to units (unitary controller and Programmable Thermostat by DX unit manufacturer); See Div 23 specs.
2. Exhaust Fans controlled by occupancy sensors.

B. **Prior to bidding**, RTU supplier shall notify general, mechanical and electrical contractor of work required for operational installation of controls. This includes, but is not limited to: installation of controls devices, sensors, needs for power, communication wiring and conduit.

1.3 GENERAL CONTROL SEQUENCES

A. All setpoints used in controls sequences shall be user adjustable with a minimum of keystrokes.

B. System program shall incorporate individual Off/Enable or Start/Stop times for each output point for RTUs, Outside Air (OA) dampers, scheduled as per Owner's input. Each individual equipment item is to have its programmable Off/Enable or Start/Stop scheduling capability.

C. Occupied hours, Off/Enable: Program times per Owner's input. Each system will have a dedicated time schedule. Each OA damper shall have an independent dedicated time schedule as well. In general, there are a minimum of two distinct time schedules for the building. Occupied time schedule is when the buildings actually have occupancy (eg. 8AM to 5:30PM). This schedule is used for scheduling ventilation, OA, etc. The second time schedule is used for the RTU On/Off times and will include morning cool down and optimal start/stop times, etc. (eg. 5AM to 7PM).

D. Stagger AHU start times by a minimum of 20 seconds between starts.

E. Unoccupied hours, Off / Enable:
1. Enable cooling if space air temperature rises above 90˚F (adj.). Disable unit once temperature has fallen to 85˚F (adj.) or below.
2. Enable heating if space air temperature drops below 45˚F (adj.). Disable unit once temperature has risen to 55˚F (adj.).

3. Enable cooling if relative humidity rises above 60% (adj.). Disable unit once relative humidity has fallen to 55% (adj.).
4. Manual Override: Control may be manually overridden at the Thermostat.
5. Hardware Interlocks: Controls shall not bypass any safeties or interlocks associated with fire protection shutdown.

F. Interlocks:
1. Hardware: Do not bypass safeties or interlocks associated with fire protection shutdown.
2. Provide all hardware necessary to achieve software interlocks required for proper system operation, including but not limited to control of dampers and exhaust fans. Coordinate with mechanical and electrical contractors.

1.4 SPACE TEMPERATURE SETPOINTS

A. Cooling Mid-range setpoint = 75˚F.

B. Heating Mid-range setpoint = 70˚F.

C. Program system to allow a setpoint range of 1.5˚F (adj) either side of mid-range setpoints.

1.5 CONTROL SEQUENCES FOR DX RTUS

A. Coordinate sequences with those specified in Div. 23, Section 237413. Sequences shall be similar to those provided by Lennox LCH Energence Series hot gas reheat units.

B. Fan Control: **System** starts fan to run continuously during occupied periods. **System** cycles fan during unoccupied periods.
1. Signal alarm if fan fails to start as commanded.
2. Fan shall vary speed in coordination with compressor staging.

C. Unoccupied Mode Enable / Disable: During unoccupied hours, enable unit operation and control under the conditions listed below. Unit shall run for a minimum of 30 min. or until space conditions are satisfied.

D. Start-Up Operation: In the order of priority, start-up operation shall be commanded as follows:
1. Initiate unit, command to Cooling Mode if space temperature is above cooling setpoint.
2. Initiate unit, command to Heating Mode, if space temperature is below heating setpoint.
3. If temperature setpoint is satisfied at start-up, but RH setpoint is not, initiate unit in Dehumidification Mode. There shall be no exceptions to this.

E. Cooling Mode:
1. System cycles compressor stages to maintain space air temperature setpoint (74F, adj.).
2. Should space RH as measured by system surpass setpoint of 55% RH, activate dehumidification mode. See Div 23 specifications for RTUs.

F. Dehumidification Mode:
1. If space temperature setpoint is satisfied, but space RH level is above setpoint (55%, adj.), cycle compressor stages and hot gas reheat valve to maintain space RH setpoint.

2. Close outside air damper and disable cooling if space temperature drops 1.5°F (adjustable) below space temperature set point.
3. System shall terminate Mode when space humidity drops below setpoint by (5%, adj.), or if system is commanded to Cooling Mode.

G. Heating Mode (Electric):
1. During occupied periods, when fan is running, **system** enables one stage of heat when space temperature drops below heating setpoint (69F, adj.).
2. If a stage is enabled and space temperature continues to remain below setpoint by 2°F for more than 5 minutes, system enables additional heat stage, similarly for additional stages.
3. System disables stages, one at a time, when temperature rises above setpoint by 2°F for more than 5 minutes. Coordinate number of stages with heater.
4. Humidity sensors: Shall be provided by equipment manufacturer.

H. Outside-Air Control for all other units:
1. Unoccupied Periods: OA Damper Position: Closed.
2. Normal Operation: OA Damper Position: Open when compressor is ON. Open in heating mode. Closed when unit is in cooling mode and compressors cycle off.
3. Economizer mode per IECC.

1.6 OTHER SEQUENCES

A. Building exhaust fans controlled by occupancy sensors installed under Div. 26.

B. Provide up to 4 hours of programming to account for additional control sequences and fine-tuning above sequences, during the course of the project.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230993

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Single-wall rectangular ducts and fittings.
   2. Single-wall, spiral-seam, round ducts and fittings.
   3. Sheet metal materials.
   4. Duct liner.
   5. Sealants and gaskets.
   6. Hangers and supports.

B. Related Sections:
   1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
   2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. Duct system design, as indicated, has been used to select size and type of air-moving and -distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.
3. Fire-Stopping Materials.

B. Shop Drawings:
1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Delegated-Design Submittal:
1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:
    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.
    f. Perimeter moldings.

B. Welding certificates.

C. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
   2. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. Round, Spiral Lock-Seam Ducts.

B. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers:
   a. Lindab Inc.
   b. McGill AirFlow LLC.
   c. SEMCO Incorporated.
   d. Sheet Metal Connectors, Inc.
   e. Spiral Manufacturing Co., Inc.

C. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

D. Duct Joints:
1. Ducts up to 20 Inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
2. Ducts 21 to 72 Inchesin Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
3. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.
   a. Manufacturers:
      1) Ductmate Industries, Inc.
      2) Lindab Inc.

E. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.

F. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.

G. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Unless elbow construction type is indicated, fabricate elbows as follows:
1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
2. Round Mitered Elbows with Aerofoil Vanes: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg:
   a. Ducts 3 to 36 Inches in Diameter: 0.034 inch.
   b. Ducts 37 to 50 Inches in Diameter: 0.040 inch.

3. 90-Degree, 2-Piece, Mitered Elbows: Use only for supply systems or for material-handling Class A or B exhaust systems and only where space restrictions do not permit using radius elbows. Fabricate with single-thickness turning vanes.
4. Round Elbows 8 Inchesand Less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
5. Round Elbows 9 through 14 Inchesin Diameter: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.

6. Round Elbows Larger than 14 Inches in Diameter and All Flat-Oval Elbows: Fabricate gored elbows unless space restrictions require mitered elbows.
7. Die-Formed Elbows for Sizes through 8 Inches in Diameter and All Pressures 0.040 inch thick with 2-piece welded construction.
8. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
9. Pleated Elbows for Sizes through 14 Inchesin Diameter and Pressures through 10-Inch wg: 0.022 inch.

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
1. Galvanized Coating Designation: G90.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

E. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
1. Manufacturers:
   a. Owens Corning’s Aeroflex Plus Duct Liner or Equal.

2. Materials: ASTM C 1071; surfaces exposed to airstream shall be coated to prevent erosion of glass fibers.
   a. Maximum Thermal Conductivity:
   b. Thickness: 1 inch for sound attenuation, and R8 for thermal insulation.
   c. Thermal Conductivity (k-Value): 0.26 at 75 deg Fmean temperature.
   d. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E84.

e. Water-Based Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

f. Mechanical Fasteners: Galvanized steel suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in duct.

1) Tensile Strength: Indefinitely sustain a 50-lb-tensile, dead-load test perpendicular to duct wall.

2) Fastener Pin Length: As required for thickness of insulation and without projecting more than 1/8 inch into airstream.

3) Adhesive for Attaching Mechanical Fasteners: Comply with fire-hazard classification of duct liner system.

3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.

2.5 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 4 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.

5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.
1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.6 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.7 FIRE-STOPPING

A. Fire-Resistant Sealant: Provide two-part, foamed-in-place, fire-stopping silicone sealant, one-part elastomeric sealant, formulated for use in a through-penetration fire-stop system for filling openings around duct penetrations through walls and floors, having fire-resistance ratings indicated as established by testing identical assemblies per ASTM E 814 by Underwriters Laboratory, Inc. or other testing and inspecting agency acceptable to authorities having jurisdiction.

B. Products: Subject to compliance with requirements, products that may be incorporated in the Work are limited to, the following:
1. "Dow Corning Fire Stop Foam"; Dow Corning Corp.
2. "Dow Corning Fire Stop Sealant"; Dow Corning Corp.
3. "3M Fire Barrier Caulk CP-25"; Electrical Products Div./3M.

C. Seams and laps arranged on top of duct.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round and flat-oval ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 APPLICATION OF LINER IN RECTANGULAR DUCTS

A. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.

B. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.

C. Butt transverse joints without gaps and coat joint with adhesive.

D. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.

E. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and standard liner product dimensions make longitudinal joints necessary.

F. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.

G. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.

H. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
   1. Fan discharges.
   2. Intervals of lined duct preceding unlined duct.
   3. Upstream edges of transverse joints in ducts where air velocities are greater than 2500 fpm or where indicated.

I. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

3.4 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible", and as defined below.
   1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   2. All Ducts U.N.O: Seal Class A.
   3. Unconditioned Space, Return-Air Ducts: Seal Class B.
   4. Conditioned Space, Return-Air Ducts: Seal Class C.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
   1. Where practical, install concrete inserts before placing concrete.
   2. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.6 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 9 Sections.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:
   1. **Comply with requirements for Leakage Class A for sealing all ducts.** Refer to SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
   2. Test the following systems:
      a. Supply, Return, Exhaust, Outdoor Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.
      b. Engineer will randomly designate two supply duct systems for testing in accordance with Section 4 of SMACNA HVAC Air Duct Leakage Test Manual, current edition. If leakage test results exceed SMACNA allowable leakage rates, then additional two systems shall be tested. Supply duct test section shall include main trunk line from the mechanical room to the farthest VAV box. For systems without VAV boxes, main trunk shall be determined on site

   3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
   4. Test for leaks before applying external insulation.
   5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
   6. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:
   1. Visually inspect duct system to ensure that no visible contaminants are present.
   2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
      a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.9 DUCT CLEANING

A. Clean new and existing duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.
   1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
   2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
   3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:
   1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
   2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:
   1. Air outlets and inlets (registers, grilles, and diffusers).
   2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
   3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
   4. Coils and related components.
   5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
   6. Supply-air ducts, dampers, actuators, and turning vanes.
   7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:
   1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.

2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.10 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.11 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

A. Supply Ducts:
   1. Ducts Connected to Fan Coil Units, and Terminal Units:
      a. Pressure Class: Positive 2-inch wg.
      b. Minimum SMACNA Seal Class: A
   2. Ducts Connected to Constant-Volume Air-Handling Units
      a. Pressure Class: Positive 4-inch wg
      b. Minimum SMACNA Seal Class: A

B. Return Ducts:
   1. Ducts Connected to Fan Coil Units, and Terminal Units
      a. Pressure Class: Positive or negative 2-inch wg
      b. Minimum SMACNA Seal Class: B.
   2. Ducts Connected to Air-Handling Units
      a. Pressure Class: Positive or negative 3-inch wg
      b. Minimum SMACNA Seal Class: B

C. Exhaust Ducts:
   1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
      a. Pressure Class: Negative 2-inch wg
      b. Minimum SMACNA Seal Class: A

D. Elbow Configuration:
   1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."

a. Double Skin vaned elbows. See drawings.

2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."
   a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
      1) Radius-to Diameter Ratio: 1.5.

   b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
   c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

E. Branch Configuration:
   1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
      a. Rectangular Main to Rectangular Branch: 45-degree entry.
      b. Rectangular Main to Round Branch: Spin in.
   2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
      a. Velocity 1000 fpm or Lower: 90-degree tap.
      b. Velocity 1000 to 1500 fpm: Conical tap.
      c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 233113

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. Backdraft and pressure relief dampers.
2. Barometric relief dampers.
3. Manual volume dampers.
4. Control dampers.
5. Fire dampers.
6. Flange connectors.
7. Turning vanes.
8. Remote damper operators.
9. Duct-mounted access doors.
10. Flexible connectors.
11. Flexible ducts.
12. Duct accessory hardware.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.
b. Manual volume damper installations.
c. Control-damper installations.
d. Fire-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
e. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

B. Source quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

1.7 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with AMCA 500-D testing for damper rating.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
   1. Galvanized Coating Designation: G90.
   2. Exposed-Surface Finish: Mill phosphatized.

B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304.

C. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

D. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. Nailor Industries Inc.
3. Pottorff.
4. Ruskin Company.

B. Description: Gravity balanced. Blades of maximum 6-inch width, with sealed edges, assembled in rattle-free manner, steel ball bearings, and axles.

C. Frame: Hat-shaped, 0.05-inch-thick, galvanized sheet steel, with welded corners and mounting flange.

D. Blades: Multiple single-piece blades, 0.050-inch-thick aluminum sheet with sealed edges.

E. Blade Action: Parallel.

F. Blade Seals: Neoprene, mechanically locked.

G. Blade Axles:
1. Material: Galvanized steel.

H. Tie Bars and Brackets: Galvanized steel.

I. Return Spring: Adjustable tension.

J. Accessories:
1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.
3. Electric actuators, where noted.
4. Chain pulls.
5. Screen Mounting: Front mounted in sleeve.
    a. Sleeve Thickness: 20 gage minimum.
    b. Sleeve Length: 6 inches minimum.
6. Screen Mounting: Rear mounted.
7. Screen Material: Stainless steel.
8. Screen Type: Bird.
9. 90-degree stops.

2.4 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Flexmaster U.S.A., Inc.
    b. McGill AirFlow LLC.
    c. Nailor Industries Inc.
    d. Pottorff.
    e. Ruskin Company.
2. Standard leakage rating, with linkage outside airstream.
3. Suitable for horizontal or vertical applications.
4. Frames:
    a. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel.
    b. Mitered and welded corners.
    c. Flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:
    a. Multiple or single blade.
    b. Parallel- or opposed-blade design.
    c. Stiffen damper blades for stability.
    d. Galvanized-steel, 0.064 inch thick.
6. Blade Axles: Galvanized steel.
7. Tie Bars and Brackets: Galvanized steel.

B. Standard, Aluminum, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. McGill AirFlow LLC.
    b. Nailor Industries Inc.
    c. Pottorff.
    d. Ruskin Company.
2. Standard leakage rating, with linkage outside airstream.
3. Suitable for horizontal or vertical applications.
4. Frames: Hat-shaped, 0.10-inch-thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:
    a. Multiple or single blade.
    b. Parallel- or opposed-blade design.
    c. Stiffen damper blades for stability.
    d. Roll-Formed Aluminum Blades: 0.10-inch-thick aluminum sheet.

e. Extruded-Aluminum Blades: 0.050-inch-thick extruded aluminum.

6. Blade Axles: Galvanized steel.
7. Tie Bars and Brackets: Aluminum.

C. Low-Leakage, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Pottorff.
b. Ruskin Company.

2. Comply with AMCA 500-D testing for damper rating.
3. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
4. Suitable for horizontal or vertical applications.
5. Frames:

a. Hat shaped.
b. 0.094-inch-thick, galvanized sheet steel.
c. Mitered and welded corners.
d. Flanges for attaching to walls and flangeless frames for installing in ducts.

6. Blades:

a. Multiple or single blade.
b. Parallel- or opposed-blade design.
c. Stiffen damper blades for stability.
d. Galvanized, roll-formed steel, 0.064 inch thick.

7. Blade Axles: Galvanized steel.
8. Blade Seals: Neoprene.
9. Tie Bars and Brackets: Galvanized steel.
10. Accessories:

a. Include locking device to hold single-blade dampers in a fixed position without vibration.

D. Low-Leakage, Aluminum, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Pottorff.
b. Ruskin Company.

2. Comply with AMCA 500-D testing for damper rating.
3. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
4. Suitable for horizontal or vertical applications.

5. Frames: Hat-shaped, 0.10-inch-thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
6. Blades:

    a. Multiple or single blade.
    b. Parallel- or opposed-blade design.
    c. Roll-Formed Aluminum Blades: 0.10-inch-thick aluminum sheet.
    d. Extruded-Aluminum Blades: 0.050-inch-thick extruded aluminum.

7. Blade Axles: Galvanized steel.
8. Blade Seals: Neoprene.
9. Tie Bars and Brackets: Aluminum.
10. Accessories:

    a. Include locking device to hold single-blade dampers in a fixed position without vibration.

E. Jackshaft:
1. Size: 1-inch diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

F. Damper Hardware:
1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.5 CONTROL DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. Pottorff.
3. Ruskin Company.
4. Young Regulator Company.

B. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

C. Frames:
1. Hat shaped.
2. 0.094-inch-thick, galvanized sheet steel.
3. Mitered and welded corners.

D. Blades:
1. Multiple blade with maximum blade width of 6 inches.

2. Opposed-blade design.
3. Galvanized-steel.
4. 0.064 inch thick single skin.
5. Blade Edging: Closed-cell neoprene.
6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.

E. Blade Axles: 1/2-inch-diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.
1. Operating Temperature Range: From minus 40 to plus 200 deg F.

F. Bearings:
1. Molded synthetic.
2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
3. Thrust bearings at each end of every blade.

2.6 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. Pottorff.
3. Ruskin Company.

B. Type: Dynamic; rated and labeled according to UL 555 by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.

D. Fire Rating: 1-1/2 hours.

E. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.

F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
1. Minimum Thickness: 0.138 inch thick, as indicated, and of length to suit application.
2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

G. Mounting Orientation: Vertical or horizontal as indicated.

H. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch-thick, galvanized-steel blade connectors.

I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

J. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

2.7 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Nexus PDQ.
3. Ward Industries, Inc.

B. Description: Factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.8 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. METALAIRE, Inc.
3. SEMCO Incorporated.
4. Ward Industries, Inc.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

D. Vane Construction: Double wall.

2.9 REMOTE DAMPER OPERATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Pottorff.
2. Young Regulator Company.

B. Description: Cable system designed for remote manual damper adjustment.

C. Tubing: Brass.

D. Cable: Stainless steel.

E. Wall-Box Cover-Plate Material: Stainless steel.

2.10 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flexmaster U.S.A., Inc.
2. Greenheck Fan Corporation.
3. Pottorff.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."
1. Door:

a. Double wall, rectangular.
b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
c. Vision panel.
d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.

2.11 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Ward Industries, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
1. Minimum Weight: 24 oz./sq. yd..

2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

G. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.
1. Minimum Weight: 16 oz./sq. yd..
2. Tensile Strength: 285 lbf/inch in the warp and 185 lbf/inch in the filling.
3. Service Temperature: Minus 67 to plus 500 deg F.

H. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.
1. Minimum Weight: 14 oz./sq. yd..
2. Tensile Strength: 450 lbf/inch in the warp and 340 lbf/inch in the filling.
3. Service Temperature: Minus 67 to plus 500 deg F.

2.12 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Flexmaster U.S.A., Inc.
2. Thermaflex

A. Where acoustical flexible duct is shown on drawings, provide Flexmaster Type 8M (or Thermaflex M-KE) UL 181 Class I Air Duct or equal.

B. The duct shall be constructed of a CPE fabric supported by helical wound galvanized steel. The fabric shall be mechanically locked to the steel helix without the use of adhesives or chemicals.

C. The internal working pressure rating shall be at least 6” w.g. positive and 4” w.g. negative through 16” diameter, and 1” w.g. negative for 18” and 20” diameters, with a bursting pressure of at least 2 ½ time the working pressure.

D. The duct shall be rated for a velocity of at lease 4000 feet per minute.

E. The duct must be suitable for continuous operation at a temperature range of -20° F to +250° F.

F. Factory insulate the flexible duct with fiberglass insulation. The R-value shall be at least 8 at a mean temperature of 75° F.

G. Cover the insulation with a fire retardant metalized vapor barrier jacket reinforced with crosshatched scrim having a permeance of not greater than 0.05 perms when tested in accordance with ASTM E96, Procedure.

H. Sound attenuation Properties: Acoustical performance, when tested by an independent laboratory in accordance with the Air Diffusion Council’s Flexible Air Duct Test Code FD 72-R1, Section 3.0, Sound Properties, shall be as follows:

Octave Band	**2**	**3**	**4**	**5**	**6**	**7**
Hz.	125	250	500	1000	2000	4000
6” diameter	7	31	40	38	40	27
8” diameter	13	29	36	35	38	22
12” diameter	21	28	29	33	26	12

I. Flexible Duct Connectors:
   1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.

2.13 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft dampers (control dampers for fans 2,000CFM and larger) at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
   1. Install steel volume dampers in steel ducts.
   2. Install aluminum volume dampers in aluminum ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire and smoke dampers according to UL listing.

H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
   1. On both sides of duct coils.
   2. Upstream from duct filters.
   3. At outdoor-air intakes and mixed-air plenums.
   4. At drain pans and seals.
   5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.

6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
7. At each change in direction and at maximum 50-foot spacing.
8. Upstream from turning vanes.
9. Upstream or downstream from duct silencers.
10. Control devices requiring inspection.
11. Elsewhere as indicated.

I. Install access doors with swing against duct static pressure.

J. Access Door Sizes:
1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

K. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

L. Install flexible connectors to connect ducts to equipment.

M. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

N. Connect terminal units to supply ducts directly, and for fan powered boxes with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.

O. Connect flexible ducts to metal ducts with stainless steel draw bands.

P. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:
1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

SECTION 233423 - HVAC 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 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Ceiling-mounted ventilators.
   2. Centrifugal roof ventilators.
   3. In-line fans.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on sea level.

B. Operating Limits: Classify according to AMCA 99.

C. Delegated Design: Design roof curbs to comply with **wind** performance requirements, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

D. Wind-Restraint Performance rated for basic Wind Speed: Rated for project location.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:
   1. Certified fan performance curves with system operating conditions indicated.
   2. Certified fan sound-power ratings.
   3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
   4. Material thickness and finishes, including color charts.
   5. Dampers, including housings, linkages, and operators.
   6. Fan speed controllers.
   7. Roof curbs.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Wiring Diagrams: For power, signal, and control wiring.

C. Delegated-Design Submittal: For unit hangars and supports indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
   2. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.
   3. Wind Restraints and Certification.

D. Manufacturer Wind Loading Qualification Certification: Submit certification that specified equipment will withstand wind forces identified in "Performance Requirements" Article, Division 7 and in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of wind force and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
   1. Framing and support members relative to duct penetrations.
   2. Ceiling suspension assembly members.
   3. Size and location of initial access modules for acoustical tile.
   4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
   5. Roof framing and support members relative to duct penetrations.

B. Certified Compliance Statement and shop drawings from a licensed PE for IBC and TDI.
   1. Sealed shop drawings showing installation instructions and attachment of equipment to curb, and curb to structure. Include quantity and type of restraining brackets/clips, screws, spacing, etc.
   2. As a separate attachment provide sealed IBC and TDI compliant calculations for curbs and attachment.

C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Belts: One set for each belt-driven unit.

1.8 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

C. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

D. International Building Code and TDI Compliance: Licensed Professional Engineer shall certify that the listed items are designed for and will withstand wind speed for the location of the project, per the relevant edition of International Building Code, ASCE Std 7, Texas Department of Insurance requirements.
   1. Equipment curb/attachment for exterior and roof mounted equipment such as fans.
   2. Attachment of equipment to curb/pad.
   3. Attachment of curb/pad to building structure.

1.9 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

1.10 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: A written warranty, executed by Contractor and signed by manufacturer, agreeing to replace components that fail in materials and workmanship within the specified warranty period, provided manufacturer's written instructions for installation, operation, and maintenance have been followed.
   1. Warranty Period: One (1) year parts and labor for fan and motor, including all components, from date of Substantial Completion.

1.11 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. Belts: One set for each belt-driven unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. HVAC Power Ventilators: Subject to compliance with requirements, provide products by one of the following:
   1. Loren Cook Company.
   2. Greenheck Fan Corp.
   3. New York Blower Company (The).
   4. Penn Ventilation.

2.2 CEILING-MOUNTED VENTILATORS

A. Description: Centrifugal fans designed for installing in ceiling or wall or for concealed in-line applications.

B. Housing: Steel, lined with acoustical insulation.

C. Fan Wheel: Centrifugal forward curved type, injection molded of polypropylene resin for smaller fans, galvanized steel for larger fans.

D. Grille: Manufacturer's standard **Aluminum**, louvered grille with flange on intake and thumbscrew attachment to fan housing.

E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

F. Accessories:
   1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
   2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
   3. Factory mounted disconnect
   4. Stainless steel insect screen
   5. Isolation: Rubber-in-shear vibration isolators.
   6. Aluminum backdraft damper
   7. Vibration isolator kit
   8. Time-Delay Switch: See schedules for switch coordination.
   9. See schedules for other options.

2.3 IN-LINE CENTRIFUGAL AND MIXED FLOW INLINE FANS

A. Description: In-line, centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets, and accessories.

B. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

C. Direct-Driven Units: Motor encased in housing outside of airstream, factory wired to disconnect switch located on outside of fan housing.

D. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.

E. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

F. Accessories:
1. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
2. Companion Flanges: For inlet and outlet duct connections.
3. Fan Guards: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
4. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.
5. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit. **See schedules.**
6. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.
7. See schedules for other options.

2.4 IN-LINE CENTRIFUGAL FANS

A. Description: In-line mounted, centrifugal fans that are UL 705 listed, AMCA certified.

B. Housing: 20 gauge galvanized steel and acoustically insulated. Blower and motor assembly mounted on 14 ga. reinforced channel, resiliently mounted fan. Inlet and outlet duct flanges, reinforced aluminum dampers with continuous aluminum hinge rods and brass bushings.

C. Wheels: twin DWDI centrifugal forward curved type, galvanized steel, balanced in accordance with AMCA Std 204-96 Balance Quality and Vibration Levels for Fans.

D. Motor: Totally enclosed with permanently lubricated bearing and built-in thermal overload protection.

E. Accessories:
1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired.
2. For two speed exhaust fans in science laboratories, do NOT include integral disconnect switch. This will be provided by electrical. See schedules.
3. See schedules for other options.

2.5 CENTRIFUGAL ROOF VENTILATORS

A. Description: Direct- or belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

B. Housing: Removable, **spun-aluminum, dome top and outlet baffle**; square, one-piece, aluminum base with venturi inlet cone.
   1. Upblast Units (where indicated): Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains and grease collector.
   2. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.

C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

D. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:
   1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
   2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
   3. Pulleys: Cast-iron, adjustable-pitch motor pulley.
   4. Fan and motor isolated from exhaust airstream.

E. Accessories:
   1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
   2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted **inside** fan housing, factory wired through an internal aluminum conduit.
   3. Bird Screens: Removable, 1/2-inch mesh, stainless steel.
   4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
   5. Motorized Dampers for airflow 2000CFM and larger: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.
   6. Explosion proof motors and spark resistant fans where indicated.

F. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.

2.6 ROOF MOUNTED EQUIPMENT

A. Wind Restraints: Metal brackets compatible with the curb and casing, painted to match RTU, used to anchor unit to the curb, and designed for loads at Project site.

B. Ecoat or Lorenized coating on all exposed fans, vent hoods and fan cabinets

2.7 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

B. Enclosure Type: Totally enclosed, fan cooled.

2.8 SOURCE QUALITY CONTROL

A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Secure roof-mounting fans to roof curbs with cadmium-plated hardware. Refer to Division 7 Section "Roof Accessories" for installation of roof curbs.

C. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

D. Support suspended units from structure using threaded steel rods and spring hangers having a static deflection of 1 inch. Vibration-control devices are specified in Section 230548.13 "Vibration Controls for HVAC."

E. Install units with clearances for service and maintenance.

F. Label units according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.
   1. Verify that shipping, blocking, and bracing are removed.
   2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
   3. Verify that cleaning and adjusting are complete.
   4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
   5. Adjust belt tension.
   6. Adjust damper linkages for proper damper operation.
   7. Verify lubrication for bearings and other moving parts.
   8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
   9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
   10. Shut unit down and reconnect automatic temperature-control operators.
   11. Remove and replace malfunctioning units and retest as specified above.

B. Starting Procedures:
   1. Energize motor and adjust fan to indicated rpm.
   2. Measure and record motor voltage and amperage.

C. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.

D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain power ventilators.
   1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
   2. Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
   3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 233423

SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes grilles, registers, diffusers, and other air devices

B. Related Sections:

1. Section 089116 "Operable Wall Louvers" and Section 089119 "Fixed Louvers" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
2. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Samples for Initial Selection: For diffusers, registers, and grilles with factory-applied color finishes.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Duct access panels.

B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the manufacturers specified:
   1. Price Industries.
   2. Titus.

2.2 AIR DEVICES

A. Rectangular and Square Ceiling Grilles, Registers, Diffusers: See schedules for material, finish, size, pattern, damper type, and accessories.

B. Fire rated air devices: Plans indicate a “fire damper” designation on diffusers that need a fire rated air device. Coordinate with plans.

2.3 INSULATION

A. All cold surfaces that are susceptible to condensation shall be insulated.

B. Insulation may be provided by manufacturer or by installing Contractor. Coordinate with installing Contractor.

2.4 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design

requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

SECTION 237413 - PACKAGED, OUTDOOR, CENTRAL-STATION AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes high efficiency, packaged rooftop units with direct-expansion cooling, hot-gas reheat, electric-heating coils, roof curbs, integral, space temperature controls, and economizer outdoor- air damper section.

B. Refer to Div. 7 Specifications for roof curbs, restraints and attachments, and related delegated design scope of work.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design RTU supports to comply with **wind** performance requirements, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Wind-Restraint Performance rated for basic Wind Speed: Rated for project location.

1.4 SUBMITTALS

A. Product Data: Include manufacturer's technical data for each model indicated, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection. Prepare the following by or under the supervision of a qualified professional engineer:

1. Detail mounting, securing, and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
2. Structural members to which RTUs will be attached.
3. Roof openings
4. Roof curbs and flashing.
5. Wiring Diagrams: Power, signal, and control wiring.

C. Manufacturer Wind Loading Qualification Certification: Submit certification that specified equipment will withstand wind forces identified in "Performance Requirements" Article and in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of wind force and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.

F. Warranty: Special warranty specified in this Section.

G. Certified Compliance Statement and shop drawings from a licensed PE for IBC and TDI.
1. Sealed shop drawings showing installation instructions and attachment of equipment to curb, and curb to structure. Include quantity and type of restraining brackets/clips, screws, spacing, etc.
2. As a separate attachment provide sealed IBC and TDI compliant calculations for curbs and attachment.

1.5 QUALITY ASSURANCE

A. ARI Compliance:

1. Comply with ARI 210/240 and ARI 340/360 for testing and rating energy efficiencies for RTUs.
2. Comply with ARI 270 for testing and rating sound performance for RTUs.

B. ASHRAE Compliance:

1. Comply with ASHRAE 15 for refrigeration system safety.
2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.
3. Comply with applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."

D. ARI Certification: Units shall be ARI certified and listed.

E. ARI Compliance for Units with Capacities Less Than 135,000 Btuh: Rate rooftop air-conditioner capacity according to ARI 210/240, "Unitary Air-Conditioning and Air-Source Heat Pump Equipment."

1. Sound Power Level Ratings: Comply with ARI 270, "Sound Rating of Outdoor Unitary Equipment."

F. ARI Compliance for Units with Capacities 135,000 Btuh and More: Rate rooftop air-conditioner capacity according to ARI 340/360, "Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment."

1. Sound Power Level Ratings: Comply with ARI 270, "Sound Rating of Outdoor Unitary Equipment."

G. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.

H. UL Compliance: Comply with UL 1995.

I. 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.

J. International Building Code and TDI Compliance: Licensed Professional Engineer shall certify that the listed items are designed for and will withstand wind speed for the location of the project, per the relevant edition of International Building Code, ASCE Std 7, Texas Department of Insurance requirements.
1. Equipment curb/attachment for exterior and roof mounted equipment such as RTUs.
2. Attachment of equipment to curb/pad.
3. Attachment of curb/pad to building structure.

1.6 COORDINATION

A. Coordinate size, location, and installation of rooftop air-conditioner manufacturer's roof curbs and equipment supports with roof installer.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of RTUs that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
2. Warranty Period for Integrated Control System: Manufacturer's standard, but not less than three years from date of Substantial Completion.
3. Warranty Period for all other components: Manufacturer's standard, but not less than one year from date of Substantial Completion.

1.8 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. Fan Belts: **One set** for each belt-drive fan (if applicable)
2. Filters: **One set** of filters for each unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:
   1. Lennox Industries Inc. (Basis of Design)
   2. Trane
   3. Carrier
   4. Aaon
   5. Substitutions: As indicated under the general and/or supplemental conditions of these specifications. Mechanical contractor shall be responsible for electrical, mechanical, and structural changes when using a product other than the specified product. As built drawing changes is the responsibility of the mechanical contractor.

2.2 CONSTRUCTION

A. General Fabrication Requirements for Casings: Galvanized-steel construction with enamel paint finish, removable panels or access doors with neoprene gaskets for inspection and access to internal parts, minimum 1/2-inch- thick thermal insulation with foil face and no insulation exposed to air stream, knockouts for electrical and piping connections, exterior condensate drain connection, and lifting lugs. Unit cabinet surface shall be tested 500 hours in salt spray test in compliance with ASTM B117. Cabinet top cover shall be one-piece construction or where seams exit, it shall be double-hemmed and gasket-sealed.

A. Indoor Fan: Forward curved, double width, double inlet, centrifugal, direct drive (ECM) motor on 3 thru 6 ton units, belt driven motor 7.5 tons and above. Fan motor to allow MSAV (Multi stage air volume) to allow air delivery to unload with compressor. Provide self-aligning, grease lubricated, ball or sleeve bearings with permanent lubrication fittings. If belt driven fans are provided, fans shall have with adjustable motor sheaves.

B. Condenser Fan: Propeller type, directly driven by motor.

C. Motors: Permanently lubricated and have internal thermal overload protection. Provide shafts constructed of solid hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.

D. Refrigerant: R410A.

E. Refrigerant Coils: Aluminum-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.
   1. Provide an independent expansion device for each refrigeration circuit. Factory pressure tested at 450 psig and leak tested at 200 psig.
   2. Provide factory installed thermal expansion valve (TXV) for each refrigerant circuit. Factory pressure tested at 450 psig and leak tested at 200 psig.
   3. Provide stainless-steel or non-corrosive plastic drain pan under indoor coil. Galvanized steel drain pans are not acceptable.
   4. Condenser coil shall be supplied with hail guards.

5. **Provide corrosion-protection coating to condenser coils. Acceptable coating include factory applied phenolic epoxy (E-COAT or TECHNICOAT), or certified Energy Guard Coating. Coating to have a minimum 6,000 hr ASTMB117 Salt Spray rating.**

F. Compressor: Scroll compressor with integral vibration isolators or rubber grommet mounts, internal overcurrent and overtemperature protection, integral centrifugal oil pump, suction gas cooled motor, internal pressure relief, and crankcase heater.

G. Refrigeration System:

1. Compressor.
2. Condenser coil and fan.
3. Evaporator coil and fan.
4. Hot gas reheat coil.
5. Expansion valve with replaceable thermostatic element.
6. Refrigerant dryer.
7. High-pressure switch.
8. Low-pressure switch.
9. Thermostat for coil freeze-up protection during low-ambient temperature operation or loss of air.
10. Low-ambient switch.
11. Charge of refrigerant.
12. Timed Off Control: Automatic-reset control shuts compressor off after five minutes.

H. Filter Frame: Galvanized steel with metal grid on outlet side for use with MERV 8 filter media, steel rod grid on inlet side, hinged access, and with pull and retaining handles.

I. Electric Heat: Helix-wound, nickel-chrome, electric-resistance elements, and factory wired for single-point wiring connection; with time delay for element staging, and overcurrent and overheat protective devices. Heater shall have pilot duty or automatic reset line voltage limit controls and any circuit carrying more than 48 amps shall have fuse protection in compliance with N.E.C. Heater shall be UL listed and approved and provide single point power connection.

J. Dampers: Return- and outside-air dampers with neoprene seals, outside-air filter, bird screen and hood.

1. Damper Motor: Damper motor shall be direct coupled, gear driven, 24 volt, fully modulating (0-100%) design with adjustable minimum position.

K. Power Connection: Single connection of power to unit with control-circuit transformer with built-in circuit breaker. Exterior mounted fused or circuit breaker-disconnect switch in a **NEMA-4XSS** enclosure. Coordinate provision of switch with Electrical, to ensure that at least one party provides it, and that it is not duplicated.

L. Unit Controls: Solid-state control board and components contain at least the following features:

1. Indoor fan on/off delay.
2. Default control to ensure proper operation after power interruption.
3. Service relay output.
4. Unit diagnostics and diagnostic code storage.
5. Field-adjustable control parameters.

6. Dehumidification control with dehumidistat.
7. Electric heat staging.
8. Low-ambient control, allowing operation down to 0 deg F.
9. Minimum run time.
10. Night setback mode.
11. Return-air temperature limit.
12. Smoke alarm with smoke detector installed in return air for units larger than 2000 CFM.
13. Low-refrigerant pressure control.
14. Digital display of outside temperature, supply-air temperature, return-air temperature, economizer damper position, indoor-air quality, and control parameters.
15. Provide factory-installed indoor evaporator defrost control to prevent compressor slugging by interrupting compressor operation.

M. Optional Accessories:
1. Copper condensate drain trap by contractor.
2. Economizer Mode with Controls to meet latest IECC requirements.
3. **Louvered** hail guards of steel, painted to match casing.
4. Controls and control sensors.
5. Stainless steel or non-corrosive plastic drain pans.
6. Condenser coil coating.
7. Adequate insulation on all cold surfaces to prevent condensation.
8. Factory mounted controller with full digital text display of sensor readings and diagnostics.
9. Hinged access doors with quarter-turn handles for tool-less entry into compressor compartment, filter/mixing box section and fan/heater section.
10. Provide dual stage compressors or dual compressors on units 5-tons and smaller and dual speed blower and condenser fan motors.
11. Programmable Thermostat: Adjustable limited range temperature slide bar with the following features:
    a. Occupied and unoccupied schedules for OA damper controls
    b. 7 day, 24-hour time control of system stop and start.
    c. Liquid-crystal display indicating temperature, relative humidity, set-point temperature and RH, time setting, operating mode, and fan speed.
    d. Fan-speed selection, including auto setting.
    e. Password protected.

N. Fan Motor: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

2.3 ROOF CURBS

A. Roof Curb: Welded, galvanized steel, 16 gauge zinc with corrosion-protection coating, supply and return air watertight gasketing, and factory-installed wood nailer; complying with NRCA standards; minimum height of 18 inches.
1. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
    a. Materials: ASTM C 1071, Type I or II.
    b. Thickness: **2 inches**.

2. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.

a. Liner Adhesive: Comply with ASTM C 916, Type I.
b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
c. Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
d. Liner Adhesive: Comply with ASTM C 916, Type I.

B. Wind Restraints: Metal brackets compatible with the curb and casing, painted to match RTU, used to anchor unit to the curb, and designed for loads at Project site. See Div. 7 specifications.

2.4 DEHUMIDIFICATION SYSTEM

A. Provide units with hot-gas reheat coil for dehumidification. Hot-liquid reheat coils are unacceptable. The option shall consist of a hot-gas reheat coil located on the leaving side of the evaporator coil pre-piped and circuited. The option shall be equipped with a crankcase heater(s), high and low pressure switches, and thermostatic expansion valves (TXV). It allows the unit to operate in a dehumidification cycle when the space relative humidity limit is exceeded. When space humidity is below the preset limit, the unit operates in its' normal cooling mode.

B. Shall be capable of simultaneously operating both the non hot-gas reheat compressor circuits and hot-gas reheat compressor circuits of multiple compressor units when both the humidity level and the first stage cooling temperature level exceed their set points.

C. Shall be capable of prioritizing a cooling (or heating) demand over a dehumidification demand and shut off the hot-gas reheat coil circuit(s) to meet the temperature requirements. Shall be capable of turning the hot-gas reheat coil back on if the dehumidification demand still exists after the cooling (or heating) demand has been met.

D. Shall consist of a reheat coil, three-way solenoid valve, a check valve (to prevent reverse flow of refrigerant during cooling operation) and associated copper piping.

E. Reheat coil shall be constructed with enhanced aluminum fins mechanically bonded to copper tubes. Fin count shall not exceed 14 fins per inch.

F. Reheat coil shall be sized to provide 20-25 degrees F of reheat. Manufactures must be able to demonstrate sufficient reheat required to provide neutral dry air, minimum of 17°F at 55°Fdischarge air temperature.

2.5 MOTORIZED OUTDOOR AIR DAMPER

A. Shall be available factory or field installed internal to the unit to provide motorized operation of outdoor air requirements.

B. Outside air dampers shall be controlled by the main unit microprocessor based control board. This board shall be located in the main control compartment and not the outdoor section of the unit.

C. Construction

1. Shall be fully modulating (0-100%) complete with low leakage outside air dampers and controls.
2. Damper motor shall be direct coupled, gear driven, 24 volt, fully modulating (0-100%) design.
3. Outdoor air hood with filters shall be provided and constructed of G90 galvanized steel with a 0.20 – 0.30 mils urethane primer and 0.70 - 0.80 mils polyester coat on the top side and a 0.15 – 0.25 mils urethane primer and 0.20 to 0.30 mils. polyester coat on the back side. Coating shall be resistant to 500 hours of salt spray per ASTM B-117; 500 hours of humidity exposure per ASTM D2247; and 168 hours of heat resistance per ASTM D3454. Coating shall be impact resistant per ASTM D2794; Abrasion resistant per ASTM D4060; and Solvent resistant per NCCA No. II-18. Coating shall have H minimum pencil hardness per ASTM D3363. Coating shall have a 3T no tape pick off Flexibility per NCCAII-19. Coating shall have a “no tape pick off” cross hatch adhesion resistance per ASTM D3359.

D. Demand Control Ventilation (DCV): Not required.

2.6 CONTROLS

A. Cooling Controls

1. Shall support up to two stages of cooling from a factory installed DDC controller without the need for any additional controls.
2. Shall allow a blower on delay of up to 60 seconds after a cooling demand is received. The default value is zero.
3. Shall allow a blower off delay of up to 240 seconds after a cooling demand has ended. The default value is zero.
4. Shall have a minimum compressor on time of 240 seconds that can be adjusted between 60 and 510 seconds.
5. Shall have a minimum compressor off time of 300 seconds that can be adjusted between 60 and 510 seconds.
6. Shall have a default maximum high pressure switch trip occurrence during a cooling or dehumidification cycle of 3. This trip occurrence limit shall be adjustable between 1 and 8 occurrences. If this maximum limit is reached, the compressor shall be locked out and the digital output for service shall be activated.
7. Shall have a default maximum low pressure switch trip occurrence during a cooling or dehumidification cycle of 3. This trip occurrence limit shall be adjustable between 1 and 8 occurrences. If this maximum limit is reached, the compressor shall be locked out and the digital output for service shall be activated.
8. Shall have a low pressure trip read delay of 5 minutes if the compressor off time has been less than 4 hours and the outdoor temperature is less than 70°F (21°C). This delay shall be adjustable from 0 to 34 minutes. The temperature set point shall be adjustable from 10°F to 100°F (38°C). The compressor off time shall be adjustable from 1 to 6 hours.
9. Shall have a low pressure trip read delay of 15 minutes if the compressor off time has been 4 hours or greater and the outdoor temperature is less than 70°F (21°C). This delay shall be adjustable from 0 to 34 minutes. The temperature set point shall be adjustable from 10°F to 100°F. The compressor off time shall be adjustable from 1 to 6 hours.
10. Shall have a low pressure trip read delay of 2 minutes if the compressor off time has been less than 4 hours and the outdoor temperature is 70°F (21°C) or greater. This delay shall

be adjustable from 0 to 34 minutes. The temperature set point shall be adjustable from 10°F to 100°F. The compressor off time shall be adjustable from 1 to 6 hours.

11. Shall have a low pressure trip read delay of 8 minutes if the compressor off time has been 4 hours or greater and the outdoor temperature is 70°F (21°C) or greater. This delay shall be adjustable from 0 to 34 minutes. The temperature set point shall be adjustable from 10°F to 100°F (38°C). The compressor off time shall be adjustable from 1 to 6 hours.
12. Shall record an error in non-volatile memory with each pressure switch trip occurrence (either high or low) and identify the compressor circuit.
13. Shall have a low outdoor air temperature compressor lock out set point of 0°F (-18°C) for each compressor circuit. This low outdoor temperature limit set point shall be individually adjustable for each compressor circuit from 80°F (-27°C) to -30°F (-34°C).
14. Shall have a maximum allowable evaporator freezestat trip occurrence of 3 during a cooling demand and this limit shall be adjustable from 1 to 4 occurrences. The control shall shut off the compressor each time a freezestat trip occurs and record an error code in non-volatile memory. If the maximum limit is reached, the compressor shall be locked out and the digital output for service shall be activated.
15. On units with multiple condenser fans, shall have a 6 second time delay between condenser fan shut off and re-start to prevent reverse rotation of the fan. This time delay shall be adjustable between 0 and 16 seconds.
16. On units with 4 condenser fans, shall have a first stage low outdoor temperature set point of 55°F (13°C) that shall reduce the air flow through the condenser by turning off some of the fans. This set point shall be adjustable between 60°F (16°C) and 10°F (-12°C).
17. On units with 6 condenser fans, shall have a second stage low outdoor temperature set point of 40°F (4°C) that shall reduce the air flow through the condenser by turning off all the fans. This set point shall be adjustable between 60°F (16°C) and 10°F (-12°C).
18. On units with 6 condenser fans, shall have a condenser fan on delay of 2 seconds. This shall be adjustable between 0 and 240 seconds.

B. Heating Controls

1. Shall support two stages of heating control from a factory installed DDC Controller without the need for any additional controls.
2. Shall turn the supply fan on 40 seconds after a heating demand is received. This time delay shall be adjustable from 8 to 60 seconds.
3. Shall turn the supply fan off 120 seconds after a heating demand has ended. This time delay shall be adjustable from 80 to 300 seconds.
4. Shall have a delay time of 30 seconds between stages. This time delay shall be adjustable from 30 to 160 seconds.
5. Shall have a heat off delay of 100 seconds after the thermostat heating demand has ended. This heat off delay shall be adjustable from 30 to 300 seconds.
6. Shall turn off the heat and keep the supply air fan running if an over heat limit occurs
7. Shall have an adjustable maximum over heat limit trip count during a heating cycle of 3 and indicate reaching this limit by activating the digital output for service. This maximum count limit shall be adjustable from 1 to 15 counts.
8. Shall report an error with each occurrence of an over heat limit trip and identify the limit that tripped. Error code shall be stored in non-volatile memory.
9. Shall turn off the heat if the induced air flow is too low and report an error identifying the pressure switch.
10. Shall have a maximum induced air flow pressure switch trip count during a heating cycle of 3 and indicate reaching this limit by activating the digital output for service. This maximum count limit shall be adjustable from 1 to 6 counts.

C. Supply Air Fan Control
   1. Shall have continuous or automatic control for occupied periods.
   2. Shall have adjustable on/off delay for both cooling and heating operation

D. Microprocessor Based Unit Controller
   1. Integrated DDC type, solid state, microprocessor based control board shall be provided to control all operations of the unit.
   2. Shall have a blinking LED to indicate normal operation.
   3. Shall have LEDs to indicate a thermostat demand mode.
   4. Shall have a push button to reset the board. Push button shall also allow user to select pre-programmed functions or view sensor input values or diagnostic fault codes or view the firmware version.
   5. Shall have a LED to indicate data transmission along the network.
   6. Shall have provision to select the operating mode of the unit.
   7. Shall have a test mode to allow quick operation checks with shorter delays for mode changes.
   8. Shall have provision to set unit type and voltage phase.
   9. Shall have provision to set unit network address.
   10. Shall have RS-485 or RS-232 communication port for connection with a PC to use the optional interface software.
   11. Shall have a 3 wire network bus connection terminal.
   12. Shall report and error if a power failure occurs on the main control board or any of the daughter control boards. The digital output for service shall also be activated.
   13. Shall report and error if a communication failure occurs on the main control board or any of the daughter control boards. The digital output for service shall also be activated.
   14. Shall report an error if the outdoor air sensor fails and shall default control operation to the high outdoor air limits.
   15. Shall allow for sensor calibration.
   16. Thermostat Operation
      a. Shall be 2 stage heat/2 stage cool zone sensor capable when used with Building Automation System.
      b. Shall have a night set back (unoccupied) mode
      c. Shall have thermostat bounce delay of 3 seconds.
      d. Shall have return air limit control for either heating or cooling operation.
      e. Shall have an automatic change over time delay of 5 minutes between heating and cooling operation or vice versa. This time delay shall be adjustable from 1 to 15 minutes.
   17. Diagnostics
      a. Shall have 80 diagnostic fault codes. See cooling, heating, fan and unit control sections for detailed error codes.
      b. Shall store up to 80 of the most recent diagnostic fault codes in non-volatile memory
   18. Shall have 32 Digital Inputs for the following:
      a. Occupied mode
      b. Low cool demand
      c. High cool demand
      d. Low heat demand
      e. High heat demand
      f. Supply fan demand
      g. Smoke detector demand
      h. Phase monitor or loss of phase switch

i. Dirty filter indicator
j. Supply air proving indicator
k. Primary heat limit 1
l. Primary heat limit 2
m. Secondary heat limit 1
n. Secondary heat limit 2
o. Low pressure switch 1
p. Low pressure switch 2
q. Low pressure switch 3
r. Low pressure switch 4
s. High pressure switch 1
t. High pressure switch 2
u. High pressure switch 3
v. High pressure switch 4
w. Freeze protection switch 1
x. Freeze protection switch 2
y. Freeze protection switch 3
z. Freeze protection switch 4

19. Shall have 6 Analog Inputs for the following:
    a. Return air temperature sensor
    b. Supply air temperature sensor
    c. Outdoor air temperature sensor
    d. Zone Temperature Sensor
    e. Return air Relative humidity sensor
20. Shall have 18 Digital Outputs for the following:
    a. Supply air fan motor
    b. Compressor 1
    c. Compressor 2
    d. Condenser Fan 1
    e. Condenser Fan 2
    f. Condenser Fan 3
    g. Condenser Fan 4
    h. Condenser Fan 5
    i. Condenser Fan 6
    j. Heat 1
    k. Heat 2
    l. Heat 3
    m. Heat 4
    n. Critical diagnostic fault code occurrence
21. Display: May be provided at the unit, or at the Central Operator Station, or via the world wide web.
    a. Shall have three digit display for diagnostic codes and sensor readings
    b. Shall display return air, supply air and outdoor air temperatures.
    c. Shall display return air, supply air and outdoor air temperature in °F or °C
    d. Shall display RH if optional sensor installed.
    e. Shall display zone temperature if optional zone sensor is installed.
    f. Shall display damper position if optional economizer or motorized outdoor air damper is installed.
22. Fresh air temperature control
    a. Shall have selectable program for warming cold fresh ventilation air using first stage heat

b. Shall activate first stage of heating if supply air temperature falls below the selected temperature set point. The temperature set point range shall be from 40°F to 70°F.
c. The temperature at which first stage heating is turned off shall be 20°F (11°C) above the set point. This deadband shall be adjustable from 10°F (5.5°C) to 20°F.
d. The minimum cycle time for this heating operation shall be 8 minutes. This run time shall be adjustable from 2 to 30 minutes.

23. Loss of Phase or Brown Out Protection
    a. A 24V digital input shall be available to initiate unit shut down upon activation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of RTUs.

B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.

C. Examine roofs for suitable conditions where RTUs will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Roof Curb: Install on roof structure, level and secure, according to Architectural and Roofing manufacturer’s recommendation. Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Division 07 Section "Roof Accessories." Secure RTUs to upper curb rail, and secure curb base to roof framing with anchor bolts.

B. Install wind restraints according to manufacturer's written instructions.

3.3 CONNECTIONS

A. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.

B. Install piping adjacent to RTUs to allow service and maintenance.

C. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:

1. Install ducts to termination at top of roof curb.
2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
3. Connect supply ducts to RTUs with flexible duct connectors specified in Division 23 Section "Air Duct Accessories."

4. Terminate return-air duct through roof structure and insulate space between roof and bottom of unit with 2-inch- thick, acoustic duct liner.

D. Electrical System Connections: Comply with applicable requirements in Division 26 Sections for power wiring, switches, and motor controls.

E. Ground equipment according to Division 26 Section "Grounding and Bonding."

F. 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.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Report results in writing.

C. Tests and Inspections:

1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Remove and replace malfunctioning units and retest as specified above.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Complete installation and startup checks according to manufacturer's written instructions and do the following:

1. Inspect for visible damage to unit casing.
2. Inspect for visible damage to compressor, coils, and fans.
3. Inspect internal insulation.
4. Verify that labels are clearly visible.
5. Verify that clearances have been provided for servicing.
6. Verify that controls are connected and operable.
7. Verify that filters are installed.

8. Clean condenser coil and inspect for construction debris.
9. Remove packing from vibration isolators.
10. Verify lubrication on fan and motor bearings.
11. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
12. Adjust fan belts to proper alignment and tension.
13. Start unit according to manufacturer's written instructions.

    a. Start refrigeration system.
    b. Complete startup sheets and attach copy with Contractor's startup report.

14. Inspect and record performance of interlocks and protective devices; verify sequences.
15. Operate unit for an initial period as recommended or required by manufacturer.
16. Calibrate thermostats.
17. Adjust and inspect high-temperature limits.
18. Inspect outdoor-air dampers for proper stroke.
19. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F above return-air temperature:

    a. Coil leaving-air, dry- and wet-bulb temperatures.
    b. Coil entering-air, dry- and wet-bulb temperatures.
    c. Outdoor-air, dry-bulb temperature.
    d. Outdoor-air-coil, discharge-air, dry-bulb temperature.

20. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
21. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.

    a. Supply-air volume.
    b. Return-air volume.
    c. Outdoor-air intake volume.

22. Simulate maximum cooling demand and inspect the following:

    a. Compressor refrigerant suction and hot-gas pressures.
    b. Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.

23. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:

    a. High-temperature limit on heater.
    b. Low-temperature safety operation.
    c. Filter high-pressure differential alarm.
    d. Economizer to minimum outdoor-air changeover.
    e. Smoke and firestat alarms.

24. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

3.6 CLEANING AND ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to **two** visits to site during other-than-normal occupancy hours for this purpose.

B. After completing system installation and testing, adjusting, and balancing RTU and air-distribution systems, clean filter housings and install new filters.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain RTUs. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 237413

SECTION 260010 - SUMMARY OF ELECTRICAL WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections and other Division 26 Specification Sections, apply to this Section.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. The following Summary of Work is intended as an aid to achieve an understanding of the various elements of work included in the project, as is not intended to be all-inclusive. Detailed descriptions of work and requirements are given in drawings and specifications.

B. Scope of Work:

1. General: The "Cameron County Appraisal District New Building Addition and Renovation" consists of an existing renovation (approximate 15,504 ft2) and an addition (approximately 2,093 ft2). This building will generally be operated from 7:30am to 5:30pm. (Monday through Friday) with occasional after hours and weekends use.
2. Electrical: Provide all materials and labor associated with complete operational electrical distribution system. Major items of work include, but are not limited to:

   (a) Electrical service: Existing to remain with modifications.

   (b) Demolition: Disconnect and reconnect H.V.A.C. equipment. Remove light fixtures, switches, miscellaneous electrical devices and fire alarm system as noted on plans.

   (c) Lighting systems: Interior and exterior lighting system shall consist of LED type.

   (d) Lighting controls (power packs, switches, occupancy sensors, etc.): provide as noted on plans specifications. In some cases, they will be ceiling mounted and others wall mounted. It's the intent for them to be wireless to automatically control the luminaires in their respective areas.

   (e) Power systems: Provide miscellaneous duplex receptacles, power for H.V.A.C. and plumbing equipment.

   (f) Fire Alarm System: Provide an addressable control panel with manual and automatic initiation devices. Monitoring and interfacing with fire sprinkle tamper and flow switches. Indicating devices shall also be provided to comply with TDLR.

   (g) Intrusion Detection System: Expand as required existing control panel to accommodate new building keypads, motion detectors and magnetic contacts as noted on drawings.

   (h) Communication and data processing equipment: Provide rough-ins only. Cabling, connectors, patch panels, racks, etc. by owner.

(i) CCTV, building access systems: Provide rough-ins only. Cameras, cabling, card keys, magnetic contracts, keypads, motion detectors, connectors, DVR, patch panels, racks, etc. by owner.

1.3 ALLOWANCES

A. Electrical: See Division 1 for electrical allowances.

1.4 COORDINATION

A. All electrical work shall be done under sub-contract to a General Contractor, who ultimately responsible for the entire project. Electrical Contractor shall coordinate all work through General Contractor, even in areas where only electrical work is to take place.

B. All questions, requests for information, submittals, and correspondence from the Electrical Contractor shall be submitted via the General Contractor, who will forward to the Architect, who will then forward to the Engineer.

C. Electrical Contractor shall not make any changes to design without written authorization from the Engineer. If changes are requested by the Owner, Architect, General Contractor, Suppliers, Manufacturers, or any others, Contractor should issue a written RFI for response by the Engineer.

D. Electrical Contractor shall issue seven (7) days written notice prior to any activities that require the presence of the Engineer at the job-site. This applies to all inspections required by specifications, and particularly to those where work will be covered (underground raceways, electrical raceways above ceiling).

E. Cooperate fully with other contractors so that work under those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.

F. Fully coordinate with Mechanical Contractor for providing power to HVAC systems and plumbing equipment.

G. Issue written notification of the following tasks and allow five (5) days for Engineer to respond and schedule an inspection as required:

1. Upon completion of underground raceways installation and prior to covering up.
2. Upon completion of installing all raceways, labeling all j-boxes and prior to suspended ceiling installation.
3. Upon completion of pulling all wiring, making all terminations, labeling and color-coding wires at the panelboards and prior to installing their covers.
4. When ready to request manufacturer’s start-up of each piece of equipment.
5. When ready to conduct complete Fire Alarm, and Intrusion Detection demonstration.
6. When ready for Substantial Completion Inspection.
7. When ready for Final Inspection.

Failure to issue written notification may result in work having to be redone to allow for proper inspection. It is this contractor’s responsibility to make sure Engineer receives notification.

H. CCTV and voice-data communications systems: This work shall be provided by others (not part of this contract). Fully cooperate/coordinate with this contractor for his cabling, outlets (connectors), cable tray, racks (UPS, fans), and etc. installation.

1.5 UTILITIES

1. Coordinate with power, water, telephone, cable and gas utilities to locate all utilities prior to digging in any area.
2. Obtain any approvals required from utilities to relocate utilities.
3. Cost of relocating or bypassing utilities indicated on drawings shall be included in Base Bid.
4. Coordinate with utility for electrical service. Base bid shall include all costs associated with service connection, including permit fees.

1.6 CONTRACTOR USE OF PREMISES

A. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.

1. Owner Occupancy: Allow for Owner occupancy and use by the public.
2. Driveways and Entrances: Keep driveways and entrances serving the premises, clear and available to the Owner, the Owner's employees, and emergency vehicles at all time. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

B. Site Safety: Take every precaution to ensure the site does not present a threat to the safety of occupants and/or workers. Minimal safety requirements include, but are not limited to the following:

1. Temporary fencing around construction areas.
2. Yellow caution tape and construction barricades along open trenches during the day. Trenches shall be covered at night and warning lights provided on construction barricades.
3. Temporary fencing around equipment while site work is in progress.

C. Work shall take place with minimal disruption to Owner's operations in areas surrounding the job site.

1.7 SUBMITTALS -Special Requirements

A. Manufacturer's standard dimensioned drawings, performance and product data shall be edited to delete reference to equipment, features, or information, which is not applicable to the equipment being supplied for this project. Including Bill or List of Materials.

B. Faxes and copies of faxes are not acceptable.

C. Electrical Submittals shall be submitted electronically. **Please organize the files as noted below** (PDF format - searchable). Files would need to be properly identified (cover letter, stamped, etc.) from the general contractor.

1. Miscellaneous Electrical – Submittal #1
   a. 260519 Low-Voltage Electrical Power Conductors and Cables
   b. 260526 Grounding and Bonding for Electrical Systems
   c. 260529 Hangers and Supports for Electrical Systems

d. 260533 Raceways and Boxes for Electrical Systems
e. 260544 Sleeves and Sleeve Seals for Electrical Raceways and Cabling
f. 260553 Identification for Electrical Systems
g. 262726 Wiring Devices
h. 260850 Hand Dryer

2. Electrical Gear **Submittal #2**
   a. 262416 Panelboards
   b. 262813 Fuses
   c. 262816 Enclosed Switches and Circuit Breakers
   d. 262913 Enclosed Controllers

3. Light Fixtures **Submittal #3**
   a. 265116 Interior Lighting
   b. 265219 Emergency and Exit Lighting
   c. 265621 Exterior Lighting
   d. 260923 Lighting Control Devices

4. Special Systems: **Submittal #4**
   a. 267210 Fire Alarm System
   b. 267240 Intrusion Detection System

5. Electrical Commissioning **Submittal #5**
   a. 260800 Commissioning for Electrical Systems

E. Individual submittals shall not be reviewed until a complete package is received.

F. Allow two weeks for initial submittal review by Engineer, from the day it is received at the Engineer's office.

G. Allow one week for review of resubmittals by Engineer.

H. All submittal review comments shall be forwarded by Engineer to Architect, who will then distribute as per Division 1.

1.8 SCHEDULE OF VALUES -Special Requirements

A. Electrical Contractor shall submit a Schedule of Values reflecting the total value of Electrical Work in the Contract and broken down into the following items as a minimum, with a line item for Materials/Equipment and another for Labor.

ELECTRICAL
1. Electrical gear.
4. Interior raceways including wiring.
5. Interior Light fixtures
6. Exterior light fixtures
7. Wiring devices.
8. Fire alarm system
9. Intrusion detection
10. Commissioning
11. Allowances.
12. Miscellaneous.

13. Administrative and project management.

1.9 CODE COMPLIANCE:

The design for this project is based on:

1. Occupational Safety and Health Act (OSHA)
2. National Electric Code (NEC)
3. National Fire Code
4. International Building Code
5. UL 916
6. Local ordinances

END OF SECTION 260010

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member Company of NETA or an NRTL.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Manufacturer:

1. Senator Wire & Cable Company.
2. Southwire Company.
3. Encore Wire

B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN/THWN-2, Type XHHW-2 and Type SO.

D. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for metal-clad cable, Type MC and Type SO with ground wire.

2.2 CONNECTORS AND SPLICES

A. Manufacturers:

1. AFC Cable Systems, Inc.
2. AMP Incorporated/Tyco International.
3. Hubbell/Anderson.
4. O-Z/Gedney; EGS Electrical Group LLC.
5. 3M Company; Electrical Products Division.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger, except VFC cable, which shall be extra flexible stranded.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW-2, single conductors in raceway.

B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls and Partitions: Type THHN/THWN-2, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and underground: Type THHN/THWN-2, single conductors in raceway.

E. Exposed Branch Circuits: Type THHN/THWN-2, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and underground: Type THHN/THWN-2, single conductors in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, which will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

A. 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-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors and conductors for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.

    a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
    b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

B. Test and Inspection Reports: Prepare a written report to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

C. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes grounding and bonding systems and equipment.

B. Section includes grounding and bonding systems and equipment, plus the following special applications:

1. Underground distribution grounding.
2. Foundation steel electrodes.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section "Operation and Maintenance Data," include the following:

a. Instructions for periodic testing and inspection of grounding features at ground rings and grounding connections for separately derived systems based on and NFPA 70B.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.2 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless **exothermic**-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 10 AWG and smaller, and stranded conductors for No. 8 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches below grade.

C. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Metal-clad cable runs.
8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the distribution panel to equipment grounding bar terminal on busway.

C. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

D. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from

panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

3.4 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting 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.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

3.5 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at individual ground rods. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without 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.
    b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned 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.

B. Grounding system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

D. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).
5. Manhole Grounds: 10 ohms.

E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

a. Hangers.
b. Steel slotted support systems.
c. Nonmetallic support systems.
d. Trapeze hangers.
e. Clamps.
f. Turnbuckles.
g. Sockets.
h. Eye nuts.
i. Saddles.
j. Brackets.

2. Include rated capacities and furnished specialties and accessories.

B. Shop Drawings: For fabrication and installation details for electrical hangers and support systems.

1. Trapeze hangers. Include product data for components.
2. Steel slotted-channel systems.
3. Nonmetallic slotted-channel systems.
4. Equipment supports.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Structural members to which hangers and supports will be attached.
3. Size and location of initial access modules for acoustical tile.
4. Items penetrating finished ceiling, including the following:

    a. Lighting fixtures.
    b. Speakers.
    c. Sprinklers.
    d. Access panels.
    e. Projectors.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M.
2. AWS D1.2/D1.2M.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame Rating: Class 1.
2. Self-extinguishing according to ASTM D 635.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4 factory-fabricated components for field assembly.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Allied Tube & Conduit.
    b. Cooper B-Line, Inc.; a division of Cooper Industries.
    c. ERICO International Corporation.
    d. GS Metals Corp.
    e. Thomas & Betts Corporation.

f. Unistrut; Tyco International, Ltd.
g. Wesanco, Inc.

2. Material: Plain steel.
3. Channel Width: 1-1/4 inches.
4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
5. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
6. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
7. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
8. Channel Dimensions: Selected for applicable load criteria.

B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.

E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Hilti Inc.
      2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      3) MKT Fastening, LLC.
      4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Cooper B-Line, Inc.; a division of Cooper Industries.
      2) Empire Tool and Manufacturing Co., Inc.
      3) Hilti Inc.
      4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      5) MKT Fastening, LLC

3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
    a. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
    b. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
    c. Toggle Bolts: All-steel springhead type.
    d. Hanger Rods: Threaded steel.
    e. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
    f. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
    g. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
    h. Toggle Bolts: All-steel springhead type.
    i. Hanger Rods: Threaded steel

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems unless requirements in this Section are stricter.

B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs and RMCs as scheduled in NECA 1, where its Table 1 lists maximum spacings that are less than those stated in] NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

    1. Secure raceways and cables to these supports with two-bolt conduit clamps.

E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMTs, and RMCs may be supported by openings through structure members, according to NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel: Spring-tension clamps.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Architectural Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Sections "Exterior Painting", "Interior Painting" and "High-Performance Coatings" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.
7. Handholes and boxes for exterior underground cabling.

1.3 DEFINITIONS

A. GRC: Galvanized rigid steel conduit.

B. IMC: Intermediate metal conduit.

C. EMT: Electrical metallic tubing.

D. ENT: Electrical nonmetallic tubing.

E. EPDM: Ethylene-propylene-diene terpolymer rubber.

F. FMC: Flexible metal conduit.

G. LFMC: Liquidtight flexible metal conduit.

H. LFNC: Liquidtight flexible nonmetallic conduit.

I. NBR: Acrylonitrile-butadiene rubber.

J. RNC: Rigid nonmetallic conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.
5. Electri-Flex Co.
6. Manhattan/CDT/Cole-Flex.
7. Maverick Tube Corporation.
8. O-Z Gedney; a unit of General Signal.
9. Wheatland Tube Company.
10. Hylsa

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch, minimum.

E. EMT: Comply with ANSI C80.3 and UL 797.

F. FMC: Comply with UL 1; zinc-coated steel.

G. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
2. Fittings for EMT:

    a. Material: die cast.
    b. Type: compression.

3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

I. Joint Compound for GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. Arnco Corporation.
4. CANTEX Inc.
5. CertainTeed Corp.; Pipe & Plastics Group.
6. Condux International, Inc.
7. ElecSYS, Inc.
8. Electri-Flex Co.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT/Cole-Flex.
11. RACO; a Hubbell Company.
12. Thomas & Betts Corporation.

B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. RNC: Type EPC-40-PVCcomplying with NEMA TC 2 and UL 651 unless otherwise indicated.

D. LFNC: Comply with UL 1660.

E. RTRC: Comply with UL 1684A and NEMA TC 14.

F. Fittings for and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

G. Fittings for LFNC: Comply with UL 514B.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 or Type 3R unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hoffman.
2. Lamson & Sessions; Carlon Electrical Products.

B. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.

D. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

2.5 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Thomas & Betts Corporation.
b. Walker Systems, Inc.; Wiremold Company (The).
c. Wiremold Company (The); Electrical Sales Division.
d. Panduit.

2.6 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman.
5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
6. O-Z/Gedney; a unit of General Signal.
7. RACO; a Hubbell Company.
8. Robroy Industries, Inc.; Enclosure Division.
9. Spring City Electrical Manufacturing Company.
10. Thomas & Betts Corporation.
11. Walker Systems, Inc.; Wiremold Company (The).

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.

E. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

I. Device Box Dimensions: 4 inches by 2-1/8 inches by 2-1/8 inches deep.

J. Gangable boxes are allowed as along is permitted by the NEC.

K. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 for indoor applications and Type 3R (stainless steel) outdoor with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Fiberglass.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

L. Cabinets:

1. NEMA 250, Type 1, Type 3R galvanized-steel or 4XSS box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.7 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Concealed Conduit, Aboveground: GRC.
3. Underground Conduit: RNC, Type EPC-40-PVC.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R or Type 4SS as noted on plans.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.

2. Concealed in Ceilings and Interior Walls and Partitions: EMT
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
4. Damp or Wet Locations: GRC.
5. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 1/2-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use setscrew steel fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

G. Install surface raceways only where indicated on Drawings.

H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches of enclosures to which attached.

I. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
5. Change from RNC, Type EPC-40-PVC TO EMT or GRC before rising above floor.

J. Stub-ups to Above Recessed Ceilings:

1. Use EMT for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

L. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

O. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

Q. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

S. Surface Raceways:

1. Install surface raceway with a minimum 2-inch radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

T. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

U. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

V. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

W. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

    a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
    d. Attics: 135 deg F.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.

5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

X. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

Y. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

Z. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

AA. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

BB. Locate boxes so that cover or plate will not span different building finishes.

CC. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

DD. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 3 for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Division 3."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 3."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

6. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits but a minimum of 6 inches below grade. Align planks along centerline of conduit.
7. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

D. Install handholes with bottom below frost line, below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.

F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.7 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

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. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: Nitrile (Buna N rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel.
4. Connecting Bolts and Nuts: [Carbon steel, with corrosion-resistant coating,] of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
2. Sealant shall have VOC content of 150 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 260544

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.2 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 - PRODUCTS

2.1 POWER AND CONTROL RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

2.2 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each cable size.

B. Colors for Cables Carrying Circuits at 600 V and Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

E. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tube with machine-printed identification label. Sized to suit diameter of and shrinks to fit firmly around cable it identifies. Full shrink recovery at a maximum of 200 deg F. Comply with UL 224.

2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

C. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted, 3-mil thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical- resistant, self-laminating, protective shield over the legend. Labels sized to fit the cable diameter such that the clear shield overlaps the entire printed legend.

D. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tube with machine-printed identification label. Sized to suit diameter of and shrinks to fit firmly around cable it identifies. Full shrink recovery at a maximum of 200 deg F. Comply with UL 224.

E. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of cable it identifies and to stay in place by gripping action.

F. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of cable it identifies and to stay in place by gripping action.

2.4 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted, 3-mil- thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical- resistant, self-laminating, protective shield over the legend. Labels sized to fit the conductor diameter such that the clear shield overlaps the entire printed legend.

C. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tube with machine-printed identification label. Sized to suit diameter of and shrinks to fit firmly around conductor it identifies. Full shrink recovery at a maximum of 200 deg F. Comply with UL 224.

D. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.5 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 7 by 10 inches.

D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 10 by 14 inches.

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.6 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.

C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

2.7 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

B. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

C. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Apply identification devices to surfaces that require finish after completing finish work.

C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

E. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape with adhesive appropriate to the location and substrate.

F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

G. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

H. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Install labels at 30-foot maximum intervals.

B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power.
2. Power.
3. Fire Alarm System
4. Fire-Suppression Supervisory and Control System
5. Security System
6. Mechanical and Electrical Supervisory System
7. Control Wiring.

C. Power-Circuit Conductor Identification: For secondary conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use color-coding conductor tape. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.

D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.

    a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
    b. Colors for 208/120-V Circuits:

        1) Phase A: Black.
        2) Phase B: Red.
        3) Phase C: Blue.

    c. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

E. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

F. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use write-on tags with the conductor or cable designation, origin, and destination.

G. Control-Circuit Conductor Termination Identification: For identification at terminations provide heat-shrink preprinted tubes with the conductor designation.

H. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

J. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.
2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

K. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

L. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self- adhesive warning labels.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.

4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:

a. Power transfer switches.
b. Controls with external control power connections.

M. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

N. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer and load shedding.

O. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

a. Indoor Equipment: Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
b. Outdoor Equipment: Engraved, laminated acrylic or melamine label Stenciled legend 4 inches high.
c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:

a. Panelboards, electrical cabinets, and enclosures.
b. Access doors and panels for concealed electrical items.
c. Transformers.
d. Emergency system boxes and enclosures.
e. Disconnect switches.
f. Enclosed circuit breakers.
g. Motor starters.
h. Contactors.

i. Intercommunication and call system master and staff stations.
j. Fire-alarm control panel and annunciators.
k. Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.

3.3 INSTALLATION

Verify identity of each item before installing identification products.

END OF SECTION 260553

SECTION 260800 - COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes commissioning process requirements for the following MEP systems, assemblies, and equipment:

1. Electrical lighting and lighting controls.

B. Related Requirements:

1. Section 019113 "General Commissioning Requirements" for general commissioning process requirements and Commissioning Coordinator responsibilities.

1.3 DEFINITIONS

A. Refer to Section 019113 "General Commissioning Requirements" for additional definitions and assignment of responsibilities.

1.4 CONTRACTOR’S RESPONSIBILITIES

A. Refer to Section 019113 "General Commissioning Requirements".

B. Perform commissioning tests at the direction of the CxA.

C. Attend construction phase controls coordination meeting.

D. Participate in electrical systems, assemblies, equipment, and component maintenance orientation and inspection.

E. Provide information requested by the CxA for final commissioning documentation.

F. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for complete range of testing for the required test period.

G. Provide Project-specific construction checklists and commissioning process test procedures for actual electrical systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.

H. Direct and coordinate commissioning testing among subcontractors, suppliers, and vendors.

I. Verify testing and adjusting of Work are complete.

J. Provide test data, inspection reports, and certificates in Systems Manual.

1.5 COMMISSIONING DOCUMENTATION

A. Provide the following information to the CxA for inclusion in the commissioning plan:

1. Plan for delivery and review of systems manuals, and other documents and reports.
2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
3. Process and schedule for completing construction checklists and manufacturer's pre-start and startup checklists for electrical systems, assemblies, equipment, and components to be verified and tested.
4. Certificate of completion certifying that installation, pre-start checks, and startup procedures have been completed.
5. Certificate of readiness certifying that electrical systems, subsystems, equipment, and associated controls are ready for testing.
6. Test and inspection reports and certificates.
7. Corrective action documents.

1.6 INFORMATIONAL SUBMITTALS

A. Construction Checklists: See related Sections for technical requirements, and generate construction checklists for the following:

1. Revise list of construction checklists below to suit Project. Coordinate list with appropriate related Sections' content. Below are examples of common construction checklists.

2. Electrical lighting and lighting control systems.

B. Certificates of readiness.

C. Certificates of completion of installation, pre-start, and startup activities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Refer to Section 019113 "General Commissioning Requirements".

3.2 SYSTEMS READINESS CHECKLISTS

A. Construction Checklists: Assist CxA in the preparation of detailed Systems Readiness checklists for systems, subsystems, equipment, and components.

1. Contributors to the development of checklists shall include, but are not limited to:
    a. Systems and equipment installers.
    b. Electrical and lighting technicians.
    c. Lighting controls installers.

B. Contractor shall conduct Systems Readiness Testing to document compliance with installation and Systems Readiness checklists prepared by Commissioning Authority for Division-26 items.

C. Refer to Section 019113 "General Commissioning Requirements" for issues relating to Systems Readiness checklists and testing, description of process, details on non-conformance issues relating to pre-functional checklists and test.

D. Contractor shall participate in Pre-Functional testing activities to document electrical work associated with mechanical and plumbing systems.

3.3 SYSTEM START-UP

A. Contractor is solely responsible for system start-up. CxA may, at his discretion, witness start up procedures, but will not perform any Functional Testing of systems until Contractor has completed start-up and resolved all operating deficiencies.

3.4 TESTING PREPARATION

A. Certify that electrical systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify that electrical instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents and approved Shop Drawings and submittals, and that pretest set points have been recorded.

C. Set systems, subsystems, and equipment into operating mode to be tested according to approved test procedures (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, and alarm conditions).

D. Inspect and verify the position of each device and interlocks identified on checklists.

E. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.

F. Testing Instrumentation: Install measuring instruments and logging devices to record test data as required.

3.5 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.

B. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of automation system controllers and sensors.

C. Tests will be performed using design conditions whenever possible.

D. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the Contracting Officer and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

E. The CxA may direct that set points be altered when simulating conditions is not practical.

F. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

G. If tests cannot be completed because of a deficiency outside the scope of the electrical system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

H. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.6 FUNCTIONAL TEST PROCEDURES FOR SYSTEMS TO BE COMMISSIONED

A. General

1. The following paragraphs outline the functional test procedures for the various Div. 26 items to be commissioned. Functional testing will take place only after System Readiness checklists have been completed, equipment has been started-up, and Contractor has certified that systems are ready for functional testing.
2. All systems controlled via the Building Automation System shall have all control points and sequences tested by Controls Contractor prior to requesting testing by CX Authority.

3.7 COMMISSIONING TESTS

A. Lighting Systems:

1. Light Fixtures: Verify all lamps work without flicker.
2. Light Switches: Verify switches control lights per design
3. Lighting Controls: Verify Schedule and/or photocell controls

B. Customized system readiness checklists and function testing requirements will be released after the submittal review phase.

3.8 TRAINING AND O&M MANUALS

A. Refer to Div. 26 specifications.

END OF SECTION 260800

SECTION 26 0923 – LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Devices and associated accessories for automatic control of lighting and other loads:

1. Wallbox occupancy sensors.
2. Wireless occupancy/vacancy sensors.
3. Wireless daylight sensors.
4. Wired load control modules with wireless communication inputs for wireless sensors and control stations.
5. Wired dimmers and switches with wireless communication inputs.
6. Wireless control stations.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of sensors and wall controls with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate the placement of wall controls with actual installed door swings.
3. Coordinate the placement of daylight sensors with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
4. Coordinate the work to provide luminaires and lamps compatible with the lighting controls to be installed.
5. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Sequencing:
1. Do not install sensors and wall controls until final surface finishes are complete.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.

1. Occupancy/Vacancy Sensors: Include detailed basic motion detection coverage range diagrams.
2. Wall Dimmers: Include derating information for ganged multiple devices.

C. Samples:

1. Wallbox Controls:
   a. Show available color and finish selections.
   b. Provide one sample(s) for each product proposed for substitution.
2. Sensors: Provide one sample(s) for each product proposed for substitution.

D. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Project Record Documents: Record actual installed locations and settings for lighting controls.

F. Operation and Maintenance Data: Include detailed information on lighting control system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

G. Warranty: Submit sample of manufacturer's Warranty as specified in Part 1 under "WARRANTY". Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications:
1. Company with not less than ten years of experience manufacturing lighting controls, including products using wireless communication between devices.
2. Registered to ISO 9001, including in-house engineering for product design activities.
3. Provides factory direct technical support hotline available 24 hours per day, 7 days per week.
4. Qualified to supply specified products and to honor claims against product presented in accordance with warranty.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.06 FIELD CONDITIONS

A. Maintain field conditions within manufacturers required service conditions during and after installation.

1. System Requirements- *Lutron*, Unless Otherwise Indicated:
   a. Ambient Temperature:
      1) Lighting Controls: Between 32 and 104 degrees F (0 and 40 degrees C).

b. Relative Humidity: Less than 90 percent, non-condensing.
c. Protect lighting controls from dust.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer's Standard Warranty:

1. Manufacturer Lighting Control System Components, Except Wallbox Occupancy Sensors, Wireless Sensors, Ballasts/Drivers and Ballast Modules: One year 100 percent parts coverage, no manufacturer labor coverage.
2. Wallbox Occupancy Sensors and Wireless Sensors: Five years 100 percent parts coverage, no manufacturer labor coverage.
3. Ballasts/Drivers and Ballast Modules: Three years 100 percent parts coverage, no manufacturer labor coverage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer: *Lutron Electronics Company, Inc; www.lutron.com.*

B. Other Acceptable Manufacturers:

1. Wattstopper
2. Sensor Switch
3. Products by listed manufacturers are subject to compliance with specified requirements and 10 day prior approval by Architect

C. Substitutions:

1. All proposed substitutions (clearly delineated as such) must be submitted in writing for approval by Architect a minimum of 10 working days prior to the bid date and must be made available to all bidders. Proposed substitutes must be accompanied by a review of the specification noting compliance on a line-by-line basis.
2. Any proposed substitutions to be reviewed by Architect/Engineer. Contractor accepts responsibility and associated costs for all required modifications to related equipment and wiring. Provide complete engineered shop drawings (including power wiring) with deviations from the original design highlighted in an alternate color for review and approval by Architect prior to rough-in.

D. Source Limitations: Where possible, furnish products produced by a single manufacturer and obtained from a single supplier.

2.02 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled by Underwriters Laboratories Inc. (UL) as suitable for the purpose indicated.

B. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, programming, etc. as necessary for a complete operating system that provides the control intent indicated.

C. Design lighting control equipment for 10 year operational life while operating continually at any temperature in an ambient temperature range of 32 degrees F (0 degrees C) to 104 degrees F (40 degrees C) and 90 percent non-condensing relative humidity.

D. Electrostatic Discharge Tolerance: Design and test equipment to withstand electrostatic discharges without impairment when tested according to IEC 61000-4-2.

E. Power Failure Recovery: When power is interrupted for periods up to 10 years and subsequently restored, lights to automatically return to same levels (dimmed setting, full on, or full off) as prior to power interruption.

F. Wireless Devices:

1. Capable of diagnosing system communications.
2. Capable of having addresses automatically assigned to them.
3. Receives signals from other wireless devices and provides feedback to user.
4. Capable of determining which devices have been addressed.
5. RF Frequency: 434 MHz; operate in FCC governed frequency spectrum for periodic operation; continuous transmission spectrum is not permitted.
6. RF Range: 60 feet (18 m) line-of-sight or 30 feet (9 m) through typical construction materials between RF transmitting devices and compatible RF receiving devices.
7. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of CFR, Title 47, Part 15, for Class B application.

G. Device Finishes:

1. Wallbox Controls:
2. Standard Colors: Comply with NEMA WD1 where applicable.
3. Color Variation in Same Product Family: Maximum delta E of 1, CIE L*a*b color units per ASTM E308.
4. Visible Parts: Exhibit ultraviolet color stability when tested with multiple actinic light sources as defined in ASTM D4674. Provide proof of testing upon request.

2.03 WALLBOX OCCUPANCY SENSORS

A. General Requirements:

1. Passive Infrared Sensing:
   a. Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.
   b. Passive infrared coupled with technology for sensing fine motions; Lutron XCT Technology. Signal processing technology detects fine-motion passive infrared (PIR) signals without the need to change the sensor's sensitivity threshold.

2. Ultrasonic Sensing: Utilize an operating frequency of 32 kHz or 40 kHz, crystal-controlled to operate within plus/minus 0.005 percent tolerance.
3. Dual Technology Sensing: Passive infrared and ultrasonic sensing coupled with technology for sensing very fine motions; Lutron XCT Technology. Signal processing technology detects fine-motion passive infrared (PIR) and ultrasonic signals without the need to change the sensor's sensitivity threshold.

B. Wall Switch Occupancy/Vacancy Sensors; Lutron Maestro Series:

1. General Requirements:
   a. Turns off lighting after reasonable and adjustable time delay once the last person to occupy the space vacates a room or area. Provide adjustable timeout settings of 1, 5, 15, and 30 minutes.
   b. Switches at point of minimum energy to maximize relay life, actively adapting to variations in relay timing.
   c. Suitable for incandescent, halogen, electronic low-voltage, magnetic low-voltage, compact fluorescent, LED, magnetic fluorescent, electronic fluorescent, and fan loads.
2. Passive Infrared Wall Switch Combination Occupancy/Vacancy Sensors:
   a. Programmable to operate as an occupancy sensor (automatic-on and automatic-off) or a vacancy sensor (manual-on and automatic-off).
   b. Adjustable sensitivity (high, low presets).
   c. Selectable option to enable low light feature (automatic-on when ambient light is below threshold). Ambient light threshold to be adaptive utilizing occupant feedback; Lutron Smart Ambient Light Detection.
   d. Selectable option to inhibit automatic turn-on of lights after manual-off operation while room is occupied for applications such as presentation viewing in conference rooms and classrooms; when room is vacated, returns to normal automatic-on operation after time delay period.
   e. Product(s):
      1) Passive Infrared Wall Switch Occupancy/Vacancy Sensor*; Lutron Maestro Series, Model MS-OPS6M2-DV*: 6 A lighting (120-277 V), 3 A fan (120 V); coverage of 900 square feet (81 sq m) with mounting height of 4 feet (1.2 m); 180 degree field of view; multi-location capability using standard 3-way or companion switch (up to nine companion switches may be connected).
      2) Passive Infrared Wall Switch Occupancy/Vacancy Sensor*; Lutron Maestro Series, Model MS-OPS6M2N-DV*: 6 A lighting (120-277 V), 3 A fan (120 V); neutral required; coverage of 900 square feet (81 sq m) with mounting height of 4 feet (1.2 m); 180 degree field of view; multi-location capability using standard 3-way or companion switch (up to nine companion switches may be connected).
      3) Passive Infrared Wall Switch Occupancy/Vacancy Sensor*; Lutron Maestro Series, Model MS-OPS6M2U-DV*: 6 A lighting (120-277 V), 3 A fan (120 V); convertible to require connection to either neutral or ground; coverage of 900 square feet (81 sq m) with mounting height of 4 feet (1.2 m); 180 degree field of view; multi-location capability using standard 3-way or companion switch (up to nine companion switches may be connected).
      4) Passive Infrared Wall Switch Occupancy/Vacancy Sensor*; Lutron Maestro Series, Model UMS-OPS6M2-DV*: BAA (Buy American Act)

Compliant; 6 A lighting (120-277 V), 3 A fan (120 V); neutral required; coverage of 900 square feet (81 sq m) with mounting height of 4 feet (1.2 m); 180 degree field of view; multi-location capability using companion switch (up to nine companion switches may be connected); minimum load requirement.

2.04 WIRED OCCUPANCY SENSORS

A. General Requirements:

1. Connects directly to compatible ballasts and modules without the need of a power pack or other interface.
2. Turns off or reduces lighting automatically after reasonable time delay when a room or area is vacated by the last person to occupy the space.
3. Accommodates all conditions of space utilization and all irregular work hours and habits.
4. Comply with UL 94.
5. Self-Adaptive: Continually adjusts sensitivity and timing to ensure optimal lighting control for any use of the space.
6. Furnished with field-adjustable controls for time delay and sensitivity to override any adaptive features.
7. Power Failure Memory: Settings and learned parameters to be saved in non-volatile memory and not lost should power be interrupted and subsequently restored.
8. Furnished with all necessary mounting hardware and instructions.
9. Class 2 devices.
10. Ceiling-Mounted Sensors: Indicate viewing directions on mounting bracket.
11. Wall-Mounted Sensors: Provide swivel-mount base.
12. Color: White.

B. Wired Dual Technology Sensors:

1. Passive Infrared Sensing: Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.
2. Ultrasonic Sensing: Utilize an operating frequency of 32 kHz or 40 kHz, crystal-controlled to operate within plus/minus 0.005 percent tolerance.
3. Ceiling-Mounted Sensors: Provide customizable mask to block off unwanted viewing areas.
4. Isolated Relay: Provide an internal additional isolated relay with Normally Open, Normally Closed, and Common outputs for use with HVAC control, Data Logging and other control options Omit the choice in the following paragraph if only models with integral photocell will be used.
5. Integral Photocell: Provide an integral photocell with adjustable sensitivity to prevent lights from turning on when there is sufficient natural lightIf more than one model is required, the optional choice can be used to assign type designations.

2.05 WIRELESS SENSORS

A. General Requirements:

1. Operational life of 10 years without the need to replace batteries when installed per manufacturer's instructions.
2. Communicates directly to compatible RF receiving devices through use of a radio frequency communications link.
3. Does not require external power packs, power wiring, or communication wiring.
4. Capable of being placed in test mode to verify correct operation from the face of the unit.

B. Wireless Occupancy/Vacancy Sensors:

1. General Requirements:
   a. Provides a clearly visible method of indication to verify that motion is being detected during testing and that the unit is communicating to compatible RF receiving devices.
   b. Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.
   c. Sensing Mechanism: Passive infrared coupled with technology for sensing fine motions; Lutron XCT Technology. Signal processing technology detects fine-motion passive infrared (PIR) signals without the need to change the sensor's sensitivity threshold.
   d. Provide optional, readily accessible, user-adjustable controls for timeout, automatic/manual-on, and sensitivity.
   e. Turns off lighting after reasonable and adjustable time delay once the last person to occupy the space vacates a room or area. Provide adjustable timeout settings of 1, 5, 15, and 30 minutes.
   f. Capable of turning dimmer's lighting load on to an optional locked preset level selectable by the user. Locked preset range to be selectable on the dimmer from 1 percent to 100 percent.
   g. Color: White.
   h. Provide all necessary mounting hardware and instructions for both temporary and permanent mounting.
   i. Provide temporary mounting means for drop ceilings to allow user to check proper performance and relocate as needed before permanently mounting sensor. Temporary mounting method to be designed for easy, damage-free removal.
   j. Sensor lens to illuminate during test mode when motion is detected to allow installer to place sensor in ideal location and to verify coverage prior to permanent mounting.
   k. Ceiling-Mounted Sensors:
      1) Provide surface mounting bracket compatible with drywall, plaster, wood, concrete, and compressed fiber ceilings.
      2) Provide recessed mounting bracket compatible with drywall and compressed fiber ceilings.
   l. Wall-Mounted Sensors: Provide wall or corner mounting brackets compatible with drywall and plaster walls.
2. Wireless Combination Occupancy/Vacancy Sensors:
   a. Ceiling-Mounted Sensors: Programmable to operate as an occupancy sensor (automatic-on and automatic-off), an occupancy sensor with low light feature (automatic-on when less than one footcandle of ambient light available and automatic-off), or a vacancy sensor (manual-on and automatic-off).

b. Wall-Mounted Sensors: Programmable to operate as an occupancy sensor (automatic-on and automatic-off), or a vacancy sensor (manual-on and automatic-off).
c. Product(s):
1) Ceiling-Mounted Occupancy/Vacancy Sensor*; Lutron Radio Powr Savr Series, Model LFR2-OCR2B-P-WH* Coverage from 324 square feet (30.2 sq m) to 676 square feet (62.4 sq m) depending on ceiling height from 8 to 12 feet (2.4 to 3.7 m); 360 degree field of view.
2) Wall-Mounted Occupancy/Vacancy Sensor*; Lutron Radio Powr Savr Series, Model LFR2-OWLB-P-WH;* Minor motion coverage of 1500 square feet (139.4 sq m) and major motion coverage of 3000 square feet (278.7 sq m) with mounting height of 6 to 8 feet (1.8 to 2.4 m); 180 degree field of view.
3) Corner-Mounted Occupancy/Vacancy Sensor*; Lutron Radio Powr Savr Series, Model LFR2-OKLB-P-WH* Minor motion coverage of 1225 square feet (113.8 sq m) and major motion coverage of 2500 square feet (232.3 sq m) with mounting height of 6 to 8 feet (1.8 to 2.4 m); 90 degree field of view.
4) Hallway Occupancy/Vacancy Sensor*; << Lutron Radio Powr Savr Series, Model LFR2-OHLB-P-WH;* Major motion coverage of up to 150 feet (45.7 m) with mounting height of 6 to 8 feet (1.8 to 2.4 m); narrow field of view..

2.06 LOAD CONTROL MODULES FOR WIRELESS SENSORS AND CONTROL STATIONS

A. Provide wireless load control modules as indicated or as required to control the loads as indicated.

B. Junction Box-Mounted Modules:
1. Communicates via radio frequency with up to nine compatible wireless control stations, up to six occupancy/vacancy sensors, and one daylight sensor.
2. Plenum rated.
3. Dimming Modules:
a. Product(s):
1) 5 A dimming module with 0-10V control; << Lutron PowPak Dimming Module Model RMJ-5T-DV-B; IEC 60929 is a standard for electronic fluorescent ballasts, and is used by other lighting equipment controlled by low voltage signals including LED drivers and low voltage controlled neon. It defines specific methods for 0-10V, pulse width modulation (PWM), and Digitally Addressable Lighting Interface (DALI).
b. Single low voltage dimming module with Class 1 or Class 2 isolated 0-10V output signal conforming to IEC 60929 Annex E.2; source or sink automatically configures.
c. Configurable high- and low-end trim.
d. Relay: Rated for 0-10 V ballasts, LED drivers, or fixtures that conform with NEMA 410.
4. Relay Modules:
a. Product(s):
1) 16 A relay module, without contact closure output*; Lutron PowPak Relay Module Model RMJ-16R-DV-B;* 16 A relay module, with contact

closure output*; Lutron PowPak Relay Module Model RMJ-16RCCO1-DV-B;* 5 A relay module, without contact closure output*; Lutron PowPak Relay Module Model RMJ-5R-DV-B*.

b. Relay:
   1) Rated Life of Relay: Typical of 1,000,000 cycles at fully rated 16 A for all lighting loads.
   2) Load switched in manner that prevents arcing at mechanical contacts when power is applied to and removed from load circuits.
   3) Fully rated output continuous duty for inductive, capacitive, and resistive

2.07 WIRELESS CONTROL STATIONS

A. Product(s):

1. 2-Button Control;<*Lutron Pico Wireless Control Model PJ2-2B;*
   a. Button Marking *on drawings*
2. 2-Button Control with Night Light; *Lutron Pico Wireless Control Model PJN-2B.*
3. Wallbox Adapter; Lutron Model PICO-WBX-ADAPT.

B. Communicates directly to compatible RF receiving devices through use of a radio frequency communications link.

C. Does not require external power packs, power or communication wiring.

D. Allows for easy reprogramming without replacing unit.

E. Button Programming:

1. Single action.
2. Toggle action.

F. Includes LED to indicate button press or programming mode status.

G. Mounting:

1. Capable of being mounted with a table stand or directly to a wall under a faceplate.
2. Faceplates: Provide concealed mounting hardware.

H. Power: Battery-operated with minimum ten-year battery life (3-year battery life for night light models).

I. Finish: <<*As specified for wall controls in "Device Finishes" under LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS article above;*

2.08 SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Factory Testing; Lutron Standard Factory Testing:

1. Perform full-function factory testing on all completed assemblies. Statistical sampling is not acceptable.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that ratings and configurations of devices are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive devices.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130

B. Coordinate locations of outlet boxes provided under Section *26 0537* as required for installation of devices provided under this section.

C. Where multiple devices are installed at the same location and at the same mounting height, gang devices together under a common wall plate.

D. Install products in accordance with manufacturer's instructions.

E. Install permanent barrier between ganged devices when voltage between adjacent devices exceeds 300 V.

F. Install wall dimmers to achieve full rating specified after derating for ganging as instructed by manufacturer.

G. Sensor Locations:

1. Sensor locations indicated are diagrammatic. Within the design intent, reasonably minor adjustments to locations may be made in order to optimize coverage and avoid conflicts or problems affecting coverage, in accordance with manufacturer's recommendations.

H. Ensure that daylight sensor placement minimizes sensor view of electric light sources. Locate ceiling-mounted and luminaire-mounted daylight sensors to avoid direct view of luminaires.

I. Lamp Burn-In: Operate lamps at full output for prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

J. Identify devices<< *in accordance with Section 26 0553*>>.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

3.05 ADJUSTING

A. Sensor Fine-Tuning: Contractor to provide fine-tuning of sensor calibration.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of lighting control devices to Engineer; or owner, and correct deficiencies or make adjustments as directed.

3.08 PROTECTION

A. Protect installed products from subsequent construction operations.

END OF SECTION 26 0923

SECTION 262416 - PANELBOARDS

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. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. ATS: Acceptance testing specification.

B. GFCI: Ground-fault circuit interrupter.

C. GFEP: Ground-fault equipment protection.

D. MCCB: Molded-case circuit breaker.

E. SPD: Surge protective device.

F. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of panelboard.

1. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details.
2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
4. Detail bus configuration, current, and voltage ratings.
5. Short-circuit current rating of panelboards and overcurrent protective devices.

6. Include evidence of NRTL listing for series rating of installed devices.
7. Include evidence of NRTL listing for SPD as installed in panelboard.
8. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
9. Include wiring diagrams for power, signal, and control wiring.
10. Key interlock scheme drawing and sequence of operations.
11. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device. Include an Internet link for electronic access to downloadable PDF of the coordination curves.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing**.**

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and GFEP Types: Two spares for each panelboard.
3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.10 FIELD CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

    a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
    b. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Architect no fewer than 7 days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Architect's, Construction Manager's and Owner's written permission.
3. Comply with NFPA 70E.

1.11 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace SPD that fails in materials or workmanship within specified warranty period.

1. SPD Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Square D Co.
2. Eaton Corporation.
3. Siemens

2.2 PANELBOARDS COMMON REQUIREMENTS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NEMA PB 1.

E. Comply with NFPA 70.

F. Enclosures: Flush and Surface-mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
b. Outdoor Locations: NEMA 250, Type 3R or 4XSS (as noted on plans).
c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
d. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 5 or Type 12 (as noted on plans).

2. Height: 84 inches maximum.
3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.
4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
5. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
6. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
7. Finishes:

a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
b. Back Boxes: Same finish as panels and trim.

G. Incoming Mains:

1. Location: coordinated on the field by the electrical contractor.
2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.

H. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.

a. Plating shall run entire length of bus.
b. Bus shall be fully rated the entire length.

2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
4. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
5. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.
6. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and listed and labeled by an NRTL acceptable to authority having jurisdiction, as suitable for nonlinear loads in electronic-grade panelboards and others designated on Drawings. Connectors shall be sized for double-sized or parallel conductors as indicated on Drawings. Do not mount neutral bus in gutter.
7. Split Bus: Vertical buses divided into individual vertical sections.

I. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Terminations shall allow use of 75 deg C rated conductors without derating.
3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
6. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
7. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
8. Gutter-Tap Lugs: Mechanical type suitable for use with conductor material and with matching insulating covers. Locate at same end of bus as incoming lugs or main device.

9. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

J. NRTL Label: Panelboards or load centers shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards or load centers shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.

K. Future Devices: Panelboards or load centers shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

1. Percentage of Future Space Capacity: Ten percent.

L. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.
2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

2.3 PERFORMANCE REQUIREMENTS

A. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 1 or Type 2 (as noted on plans).

2.4 POWER PANELBOARDS

A. Panelboards: NEMA PB 1, distribution type.

B. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches high, provide two latches, keyed alike.

C. Mains: Circuit breaker or Lugs only (as noted on plans).

D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.

2.5 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

B. Mains: Circuit breaker or Lugs only (as noted on plans).

C. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.

D. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

E. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.

2.6 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers:

    a. Inverse time-current element for low-level overloads.
    b. Instantaneous magnetic trip element for short circuits.
    c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic Trip Circuit Breakers:

    a. RMS sensing.
    b. Field-replaceable rating plug or electronic trip.
    c. Digital display of settings, trip targets, and indicated metering displays.
    d. Multi-button keypad to access programmable functions and monitored data.
    e. Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.
    f. Integral test jack for connection to portable test set or laptop computer.
    g. Field-Adjustable Settings:

        1) Instantaneous trip.
        2) Long- and short-time pickup levels.
        3) Long and short time adjustments.
        4) Ground-fault pickup level, time delay, and I squared T response.
4. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
5. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
6. Arc-Fault Circuit Interrupter Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
7. Subfeed Circuit Breakers: Vertically mounted.
8. MCCB Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Breaker handle indicates tripped status.
    c. UL listed for reverse connection without restrictive line or load ratings.

d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
f. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
g. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
h. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional with field-adjustable 0.1- to 0.6-second] time delay.
i. Rating Plugs: Three-pole breakers with ampere ratings greater than 150 amperes shall have interchangeable rating plugs or electronic adjustable trip units.
j. Auxiliary Contacts: Two, SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
k. Alarm Switch: Single-pole, normally open contact that actuates only when circuit breaker trips.
l. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
m. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function with other upstream or downstream devices.
n. Multipole units enclosed in a factory assembled to operate as a single unit.
o. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
p. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

2.7 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Directory card inside panelboard door, mounted in metal frame with transparent protective cover.

1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

D. Circuit Directory: Computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.

1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

2.8 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Receive, inspect, handle, and store panelboards according to NECA 407 and NEMA PB 1.1.

C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.

D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Comply with NECA 1.

C. Install panelboards and accessories according to NECA 407 and NEMA PB 1.1.

D. Equipment Mounting:

1. Install panelboards on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete." and or Section 033053 "Miscellaneous Cast-in-Place Concrete."
2. Attach panelboard to the vertical finished or structural surface behind the panelboard.

E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

F. Mount top of trim 90 inches above finished floor unless otherwise indicated.

G. Mount panelboard cabinet plumb and rigid without distortion of box.

H. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

I. Mounting panelboards with space behind is recommended for damp, wet, or dirty locations. The steel slotted supports in the following paragraph provide an even mounting surface and the recommended space behind to prevent moisture or dirt collection.

J. Mount surface-mounted panelboards to steel slotted supports 5/8 inch in depth. Orient steel slotted supports vertically.

K. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.
2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.

L. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

M. Install filler plates in unused spaces.

N. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

O. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

E. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

D. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers and low-voltage surge arrestors stated in NETA ATS, Paragraph 7.6 Circuit Breakers and Paragraph 7.19.1 Surge Arrestors, Low-Voltage. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
    b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
    c. Instruments and Equipment:

        1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

E. Panelboards will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Overcurrent Protective Device Coordination Study."

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes. Prior to making circuit changes to achieve load balancing, inform Architect of effect on phase color coding.

1. Measure loads during period of normal facility operations.
2. Perform circuit changes to achieve load balancing outside normal facility operation schedule or at times directed by the Architect. Avoid disrupting services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After changing circuits to achieve load balancing, recheck loads during normal facility operations. Record load readings before and after changing circuits to achieve load balancing.
4. Tolerance: Maximum difference between phase loads, within a panelboard, shall not exceed 20 percent.

3.6 PROTECTION

A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Tamper-resistant receptacles.
3. Weather-resistant receptacles.
4. Snap switches.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

1.6 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
   1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
   2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
   3. Leviton Mfg. Company Inc. (Leviton).
   4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

   1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
   2. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

2.4 GFCI RECEPTACLES

A. General Description:

   1. Straight blade, feed-through type.
   2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
   3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

C. Tamper-Resistant GFCI Convenience Receptacles, 125 V, 20 A:

2.5 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Single Pole
2. Three Way

2.6 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Tamper proof metal with head color to match plate finish.
2. Material for Finished Spaces: Type 302 stainless steel, 0.04-inch thick.
3. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.7 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: Ivory or as selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.
2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black -filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
2. Test Instruments: Use instruments that comply with UL 1436.
3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Test straight-blade convenience outlets in patient-care area and hospital-grade convenience outlets for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz.

D. Wiring device will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION 262726

SECTION 262813 - FUSES

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. Cartridge fuses rated 600 V ac and less for use in the following:

    a. Control circuits.
    b. Panelboards.
    c. Enclosed controllers.
    d. Enclosed switches.

2. Spare-fuse cabinets.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.

    a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
    b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
3. Current-limitation curves for fuses with current-limiting characteristics.
4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse. Submit in electronic format suitable for use in coordination software and in PDF format.
5. Coordination charts and tables and related data.
6. Fuse sizes for elevator feeders and elevator disconnect switches.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017700 "Closeout Procedures," and or **S**ection 017823 "Operation and Maintenance Data," include the following:

1. Ambient temperature adjustment information.
2. Current-limitation curves for fuses with current-limiting characteristics.
3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse used on the Project. Submit in PDF format.
4. Coordination charts and tables and related data.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.6 FIELD CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Industries, Inc.; Bussmann Div.

2. Mersen

B. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

2.3 FUSE COVER

A. Fuse cover shall be BUSSMAN “SAMI”

2.4 SPARE-FUSE CABINET

A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.

1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
2. Finish: Gray, baked enamel.
3. Identification: "SPARE FUSES" in 1-1/2-inch- high letters on exterior of door.
4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Cartridge Fuses:
1. Motor Branch Circuits: Class RK1, time delay.
    a. 250volts - Bussman LOW-PEAK LPN-RK dual element.
    b. 600volts – Bussman LOW-PEAK LPS-RK dual element.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install spare-fuse cabinet(s) in location shown on the Drawings or as indicated in the field by Architect.

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 262813

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Molded-case circuit breakers (MCCBs).
4. Molded-case switches.
5. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Include evidence of NRTL listing for series rating of installed devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

D. Manufacturer's field service report.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Submit on translucent log-log graph paper.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Fuse Pullers: Two for each size and type.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member Company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. 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.

E. Comply with NFPA 70.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Architect and or Construction Manager no fewer than seven days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Architect's or Construction Manager's written permission.
4. Comply with NFPA 70E.

1.10 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Square D Co.
2. Eaton Corporation.
3. Siemens

2.2 FUSIBLE SWITCHES

A. Type HD, Heavy Duty, Single Throw, 240 or 600-V ac (as per connected voltage), 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicate**d** fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

B. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
5. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
6. Hookstick Handle: Allows use of a hookstick to operate the handle.
7. Lugs: Mechanical type, suitable for number, size, and conductor material.
8. Service-Rated Switches: Labeled for use as service equipment.

2.3 NONFUSIBLE SWITCHES

A. Type HD, Heavy Duty, Single Throw, 240 or 600-V ac (as per connected voltage), 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

B. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.

4. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
5. Hookstick Handle: Allows use of a hookstick to operate the handle.
6. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.4 SHUNT TRIP SWITCHES

A. General Requirements: Comply with ASME A17.1, UL 50, and UL 98, with 200-kA interrupting and short-circuit current rating when fitted with Class J fuses.

B. Switches: Three-pole, horsepower rated, with integral shunt trip mechanism and Class J fuse block; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

C. Control Circuit: 120-V ac; obtained from integral control power transformer, with primary and secondary fuses, with a control power transformer/source of enough capacity to operate shunt trip, connected pilot, and indicating and control devices.

D. Accessories:

1. Oiltight key switch for key-to-test function.
2. Isolated neutral lug; 100 percent rating.
3. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
4. Form C alarm contacts that change state when switch is tripped.
5. Three-pole, double-throw, fire-safety and alarm relay; 120-V ac coil voltage.
6. Three-pole, double-throw, fire-alarm voltage monitoring relay complying with NFPA 72.

2.5 MOLDED-CASE CIRCUIT BREAKERS

A. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

B. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

C. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

D. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:

1. Instantaneous trip.
2. Long- and short-time pickup levels.
3. Long- and short-time time adjustments.
4. Ground-fault pickup level, time delay, and I^2t response.

E. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.

F. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

G. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

H. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
6. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
7. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
8. Alarm Switch: One NC contact that operates only when circuit breaker has tripped.
9. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
10. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
11. Electrical Operator: Provide remote control for on, off, and reset operations.

2.6 MOLDED-CASE SWITCHES

A. General Requirements: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.

B. Features and Accessories:

1. Standard frame sizes and number of poles.
2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
3. Ground-Fault Protection: Comply with UL 1053; remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.

6. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic switch contacts, "b" contacts operate in reverse of switch contacts.
7. Alarm Switch: One NC contact that operates only when switch has tripped.
8. Key Interlock Kit: Externally mounted to prohibit switch operation; key shall be removable only when switch is in off position.
9. Zone-Selective Interlocking: Integral with ground-fault shunt trip unit; for interlocking ground-fault protection function.
10. Electrical Operator: Provide remote control for on, off, and reset operations.

2.7 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R OR 4XSS (as noted on drawings**)**.
3. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
6. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7 or Type 9 (as noted on drawings**)**.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
    b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
    c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Overcurrent Protective Device Coordination Study."

END OF SECTION 262816

SECTION 262913 - ENCLOSED CONTROLLERS

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 the following enclosed controllers rated 600 V and less:

1. Full-voltage manual.
1. Full-voltage magnetic.
2. Multispeed.

1.3 DEFINITIONS

A. CPT: Control power transformer.

B. MCCB: Molded-case circuit breaker.

C. MCP: Motor circuit protector.

D. N.C.: Normally closed.

E. N.O.: Normally open.

F. OCPD: Overcurrent protective device.

G. SCR: Silicon-controlled rectifier.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of enclosed controller. Include manufacturer's technical data on features, performance, electrical characteristics, ratings, and enclosure types and finishes.

B. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations, sections, details, and required clearances and service spaces around controller enclosures.

1. Show tabulations of the following:

a. Each installed unit's type and details.
b. Factory-installed devices.
c. Nameplate legends.
d. Short-circuit current rating of integrated unit.

e. Listed and labeled for integrated short-circuit current (withstand) rating of OCPDs in combination controllers by an NRTL acceptable to authorities having jurisdiction.
f. Features, characteristics, ratings, and factory settings of individual OCPDs in combination controllers.

2. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Field quality-control reports.

C. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor running overload protection suit actual motors to be protected.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Routine maintenance requirements for enclosed controllers and installed components.
2. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
3. Manufacturer's written instructions for setting field-adjustable overload relays.
4. Manufacturer's written instructions for testing, adjusting, and reprogramming reduced-voltage solid-state controllers.

1.7 MATERIALS MAINTENANCE SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Control Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
3. Indicating Lights: Two of each type and color installed.
4. Auxiliary Contacts: Furnish one spare(s) for each size and type of magnetic controller installed.
5. Power Contacts: Furnish three spares for each size and type of magnetic contactor installed.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NFPA 70.

D. IEEE Compliance: Fabricate and test enclosed controllers according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

B. If stored in areas subject to weather, cover enclosed controllers to protect them from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

B. Interruption of Existing Electrical Systems: Do not interrupt electrical systems in facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Architect and or Construction Manager no fewer than seven days in advance of proposed interruption of electrical systems.
2. Indicate method of providing temporary utilities.
3. Do not proceed with interruption of electrical systems without Architect's and or Construction Manager's written permission.
4. Comply with NFPA 70E.

1.11 COORDINATION

A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Square D Co.
2. Siemens.
3. Eaton Corporation.

2.2 FULL-VOLTAGE CONTROLLERS

A. General Requirements for Full-Voltage Controllers: Comply with NEMA ICS 2, general purpose, Class A.

B. Motor-Starting Switches: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off or on.
1. Configuration: Non-reversing or two speed (as noted on drawings).
2. Surface mounting.
3. Red and Green pilot light.
4. Additional Nameplates: HIGH and LOW for two-speed switches.

C. Fractional Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.
1. Configuration: Non-reversing.
2. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button melting alloy type.
3. Surface mounting.
4. Red pilot light.

D. Integral Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.
1. Configuration: Non-reversing.
2. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters and sensors in each phase, matched to nameplate full-load current of actual protected motor and having appropriate adjustment for duty cycle; external reset push button melting alloy type.
3. Surface] mounting.
4. Red pilot light.
5. N.C. auxiliary contact.

E. Magnetic Controllers: Full voltage, across the line, electrically held.

1. Configuration: Non-reversing.
2. Contactor Coils: Pressure-encapsulated type with coil transient suppressors.

    a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.

3. Power Contacts: Totally enclosed, double-break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
4. Control Circuits: 24 V ac; obtained from integral CPT, with primary and secondary fuses, with control power source of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.

    a. CPT Spare Capacity: 100 VA.

5. Solid-State Overload Relay:

    a. Switch or dial selectable for motor running overload protection.
    b. Sensors in each phase.
    c. Class 10/20 selectable tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
    d. Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
    e. Analog communication module.

6. N.C. and N.O., isolated overload alarm contact.
7. External overload reset push button.

F. Combination Magnetic Controller: Factory-assembled combination of magnetic controller, OCPD, and disconnecting means.

1. Fusible Disconnecting Means:

    a. NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate indicated fuses.
    b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.

2. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.
3. Nonfusible Disconnecting Means:

    a. NEMA KS 1, heavy-duty, horsepower-rated, non-fusible switch.
    b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
    c. Auxiliary Contacts: N.O. /N.C., arranged to activate before switch blades open.

4. MCP Disconnecting Means:

    a. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents, instantaneous-only circuit breaker with front-

mounted, field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
c. Auxiliary contacts "a" and "b" arranged to activate with MCP handle.
d. N.C. and N.O. alarm contact that operates only when MCP has tripped.
e. Current-limiting module to increase controller short-circuit current (withstand) rating to 100 kA.

5. MCCB Disconnecting Means:

a. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents; thermal-magnetic MCCB, with inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
b. Front-mounted, adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
c. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
d. Auxiliary contacts "a" and "b" arranged to activate with MCCB handle.
e. N.C. and N.O. alarm contact that operates only when MCCB has tripped.

2.3 MULTISPEED MAGNETIC CONTROLLERS

A. General Requirements for Multispeed Magnetic Controllers: Comply with NEMA ICS 2, general purpose, Class A.

B. Multispeed Magnetic Controllers: Two speed, full voltage, across the line, electrically held.

1. Configuration: Non-reversing; two winding.
2. Contactor Coils: Pressure-encapsulated type with coil transient suppressors.

a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.

3. Power Contacts: Totally enclosed, double break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
4. Control Circuits: 24-V ac; obtained from integral CPT, with primary and secondary fuses, with control power source of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.

a. CPT Spare Capacity: **100** VA.

5. Compelling relays shall ensure that motor will start only at low speed.
6. Accelerating timer relays shall ensure properly timed acceleration through speeds lower than that selected.
7. Decelerating timer relays shall ensure automatically timed deceleration through each speed.
8. Antiplugging timer relays shall ensure a time delay when transferring from FORWARD to REVERSE and back.

9. Solid-State Overload Relay:

    a. Switch or dial selectable for motor running overload protection.
    b. Sensors in each phase.
    c. Class 10/20 selectable] tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
    d. Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
    e. Analog communication module.

10. N.C. and N.O., isolated overload alarm contact.
11. External overload reset push button.

C. Combination Multispeed Magnetic Controller: Factory-assembled combination of reduced-voltage magnetic controller, OCPD, and disconnecting means.

1. Fusible Disconnecting Means:

    a. NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate indicated fuses.
    b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
    c. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.

2. Nonfusible Disconnecting Means:

    a. NEMA KS 1, heavy-duty, horsepower-rated, non-fusible switch.
    b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
    c. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.

3. MCP Disconnecting Means:

    a. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents, instantaneous-only circuit breaker with front-mounted, field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
    b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
    c. Auxiliary contacts "a" and "b" arranged to activate with MCP handle.
    d. N.C. or N.O. alarm contact that operates only when MCP has tripped.
    e. Current-limiting module to increase controller short-circuit current (withstand) rating to 100 kA.

4. MCCB Disconnecting Means:

    a. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents; thermal-magnetic MCCB, with inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.

b. Front-mounted, adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
c. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
d. Auxiliary contacts "a" and "b" arranged to activate with MCCB handle.
N.C.or N.O. alarm contact that operates only when MCCB has tripped.

2.4 ENCLOSURES

A. Enclosed Controllers: NEMA ICS 6, to comply with environmental conditions at installed location.

1. Dry and Clean Indoor Locations: Type 1.
2. Outdoor Locations: Type 3R or Type 4XSS (as indicated on drawings).
3. Kitchen Areas: Type 4X, stainless steel.
4. Other Wet or Damp Indoor Locations: Type 4.
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: Type 12.
6. Hazardous Areas Indicated on Drawings: Type 7 or Type 9 (as indicated on drawings).

2.5 ACCESSORIES

A. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.

1. Push Buttons, Pilot Lights, and Selector Switches: Heavy type.

a. Push Buttons: Shielded types; momentary as indicated.
b. Pilot Lights: LED types; colors as indicated; push to test.
c. Selector Switches: Rotary type.

2. Elapsed Time Meters: Heavy duty with digital readout in hours.
3. Meters: Panel type, 2-1/2-inch minimum size with 90- or 120-degree scale and plus or minus two percent accuracy. Where indicated, provide selector switches with an off position.

B. Reversible N.C./N.O. auxiliary contact(s).

C. Control Relays: Auxiliary and adjustable solid-state time-delay relays.

D. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.

E. Breather and drain assemblies, to maintain interior pressure and release condensation in Type 4, Type 4X, Type 7, and Type 9 enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.

F. Sun shields installed on fronts, sides, and tops of enclosures installed outdoors and subject to direct and extended sun exposure.

G. Cover gaskets for Type 1 enclosures.

H. Terminals for connecting power factor correction capacitors to the load side of overload relays.

I. Spare control wiring terminal blocks, quantity as indicated wired.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and surfaces to receive enclosed controllers, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine enclosed controllers before installation. Reject enclosed controllers that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems."

B. Floor-Mounted Controllers: Install enclosed controllers on 4-inch nominal-thickness concrete base. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete" and or Section 033053 "Miscellaneous Cast-in-Place Concrete."

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in each fusible-switch enclosed controller.

E. Install fuses in control circuits if not factory installed. Comply with requirements in Section 262813 "Fuses."

F. Install heaters in thermal overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.

G. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.

H. Install power factor correction capacitors. Connect to the load side of overload relays. If connected to the load side of overload relays, adjust overload heater sizes to accommodate the reduced motor full-load currents.

I. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved nameplate.
3. Label each enclosure-mounted control and pilot device.

3.4 CONTROL WIRING INSTALLATION

A. Install wiring between enclosed controllers and remote devices. Comply with requirements in Section 260523 "Control-Voltage Electrical Power Cables."

B. Bundle, train, and support wiring in enclosures.

C. Connect selector switches and other automatic-control selection devices where applicable.

1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.
2. Connect selector switches with enclosed-controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

D. Tests and Inspections:

1. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
2. Test insulation resistance for each enclosed-controller element, component, connecting motor supply, feeder, and control circuits.
3. Test continuity of each circuit.
4. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Architect/ Construction Manager before starting the motor(s).
5. Test each motor for proper phase rotation.
6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
8. Perform the following infrared (thermographic) scan tests and inspections and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each multi-pole enclosed controller. Remove front panels so joints and connections are accessible to portable scanner.
    b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each multi-pole enclosed controller 11 months after date of Substantial Completion.
    c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

9. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

E. Enclosed controllers will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports including a certified report that identifies enclosed controllers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

B. Adjust overload-relay heaters or settings if power factor correction capacitors are connected to the load side of the overload relays.

C. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable instantaneous trip elements. Initially adjust to six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Architect/Construction Manager before increasing settings.

D. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Overcurrent Protective Device Coordination Study."

3.7 PROTECTION

A. Replace controllers whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers.

END OF SECTION 262913

SECTION 265116 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior LED’s luminaires.
2. Luminaire supports.

B. Related Requirements:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.3 DEFINITIONS

A. BIM: Building information model.

B. CAD: Computer-aided design.

C. CCT: Correlated color temperature.

D. CRI: Color Rendering Index.

E. LED: Light-emitting diode.

F. Fixture: See "Luminaire."

G. IP: International Protection or Ingress Protection Rating

H. Lumen: Measured output of lamp and luminaire, or both.

I. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.

3. Include physical description and dimensions of luminaires.
4. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
5. Include photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the luminaire as applied in this Project. For LED light fixtures the adjustment factors shall be for lamps and accessories identical to those indicated for the lighting fixture as applied in this Project IES LM-79 and IES LM-80

    a. Retain or "Manufacturers' Certified Data" or "Testing Agency Certified Data" Subparagraph below. Retain first subparagraph if photometric data, based on testing by accredited manufacturers' laboratories, is considered adequate for luminaires in this Project. Retain second subparagraph if photometric data for one or more luminaires are based on independent laboratory tests; coordinate with the Interior Lighting Fixture Schedule on Drawings to indicate which units shall meet this requirement. See the Evaluations. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program (NVLAP) for Energy Efficient Lighting Products.
    b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, and required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

D. Qualification Data: For testing laboratory providing photometric data for luminaires.

E. Product Certificates: For each type of ballast for bi-level and dimmer-controlled luminaires, from manufacturer.

F. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.

G. Sample warranty.

1.5 PRIOR APPROVAL SUBMITTAL REQUESTS

A. Full submittal data , by type, clearly highlighted and arrowed to identify the specific proposed manufacturer’s nomenclature

B. Full submittal data of driver data of proposed manufacturer

C. LED lumen data will include
   1. Lumen output
   2. L70 and L90 testing
   3. Confirmation of independent test lab data ITL
   4. Color temperature and CRI with quantity of McAdam Ellipse steps
      a. Data shall include sphere and goniometer results for total lumen, total power, luminaire efficacy, CRI and junction temperature for the specified color temperature
   5. Make and brand of LED diode should be clearly identified on submittal data

D. LED dimming shall be equal in range and quality to the specified drivers, Quality of dimming to be defined by dimming range, freedom from perceived flicker or visible stroboscopic flicker, smooth and continuous change in level (no visible steps in transitions), natural square law response to control input, and stable when input voltage conditions fluctuate over what is typically experience in a commercial environment.

E. All substitutions must meet specified fixtures certifications (UL,ETL,CE,CSA, RoHS, DLC, Energy Star)

F. Provide lighting calculations with the prior approval request based on reflectance values and light loss factors provided by the engineer and displayed on lighting calculation drawings. (may be unique by area) Calculations shall be shown on one sheet with dimensions as shown on construction set. Data will be submitted electronically in dxf format on a flash drive and with printed calculations on Architectural E size sheets to scale with construction set sheets.

   1. Discrepancies between prior approval data calculations and the original design calculations will result in immediate disqualification of review due to time based constraints on the bid process

G. Prior approval request may require a sample of both the proposed and specified fixtures provided by the alternate manufacturer at NO additional cost to the project. Samples of both specified and proposed must be provided within 10 working days of request.

H. All data will be submitted electronically and in a bound format

I. Bound data will be secured in hard binder with 3” rings for ease of review or PDF file.

   1. Types will be marked with a tab by type and indexed for ease of reference

J. LED warranty information MUST be included by type and marked in RED to clearly identify the manufacturer’s warranty terms. Warranty data MUST meet or exceed the specified manufacturers terms

K. Prior approvals MUST be received and acknowledged to the specifiers office no less than 10 days prior to bid.

L. ALL prior approval data must be submitted in one package with complete information. Information that is incomplete will be rejected without review.

M. The prior approval will be returned marked approved or rejected by type with no explanation. If any specification is deemed not equal the review will be stopped, the type rejected with no explanation.

N. Lumen output for the proposed fixture must be highlighted in yellow for clear identification.

O. All inverter systems supply power to LED fixtures must have pure PWM sine wave function and work with any type of lighting load.

P. LED warranty information must be included by type and marked in red to clearly identify the manufacturer’s warranty terms. Warranty data must meet or exceed the specified manufacturers terms.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
2. Fluorescent-luminaire-mounted emergency battery pack: One for every 40 emergency lighting unit.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

A. LED luminaires
1. Provide from a single manufacturer for each luminaire type.
2. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace (materials and labor) components of luminaires that fail in materials or workmanship within specified warranty period.

1. Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

D. UL Compliance: Comply with UL 1598.

E. Recessed Luminaires: Comply with NEMA LE 4.

2.2 LED LIGHTING FIXTURES AND LED LAMPS

A. All LED products must be UL, ETL and/or CSA listed

B. All LED products must have LM-79 and LM-80 testing noted on specification sheet by an independent test lab

C. All LED products should be identified as L70 and/or L90 ratings based on independent test lab data

D. All outdoor and wet location listed products must clearly state the IP rating carried on the fixture based on independent test lab data

E. Bulb shape complying with ANSI C79.1.

F. CRI of Minimum 80. CCT of 4100 K.

G. Rated lamp life of **50,000** hours.

H. Lamps dimmable from 100 percent to 0 percent of maximum light output.

I. Nominal Operating Voltage: as noted on light fixture schedule.

J. All LED products must be serviceable for accessible for field repair needs

K. All indoor lighting color rendering should be within a 3 step McAdams ellipse. All indoor lighting should be 4000-4100 kelvin unless specifically noted

L. All control systems that interface with an LED product will be supported by a project "integrator" until project completion. This includes contact with the installer prior to installation, availability during installation, and final checkout and startup after installation. The quantity of days required for startup will be based on the manufacturer/agents discretion and need.

1. The project integrator must be capable of performing low voltage and dmx terminations. High voltage terminations are performed solely by the electrical subcontractor.
2. Reporting of final startup completion of the controls system back to the engineer is mandatory.
3. Invitation to attend the training with the owners representative should be made to the engineer no less than 5 days prior to training
4. Signature confirmation of training and startup is required within 5 business days after completion back to the engineer's office.

M. All LED drivers should be capable of 0-10 volt controls and DMX control and shall dim to 1% of total lumen output. Where specifically specified the dimming driver may be required to dim to .1% of lumen output , otherwise known as "dim to dark"

N. Driver manufacturers must have a 5 year history producing dimmable electronic LED drivers for the North American market.

O. Ambient driver temperatures must be within -20 degrees to 50 degrees C (-4 degrees to 122 degrees F)

P. Driver (internal) must limit inrush current.

1. Base specification: meet or exceed NEMA 410 driver inrush standard of 430 amp per 10 amps load with a maximum of 370 amps/2 seconds
2. Preferred specification : Meet or exceed 30ma's at 277 VAC for up to 50 watts of load and 75A at 240us att 277 VAC for 100 watts of load
3. Withstand up to a 1,000 volt surge without impairment of performance as defined by ANSI C62.41 Category A
4. No visible change in light output with a variation of plus/minus 10percent line voltage input.
5. Total harmonic distortion less than 20%, and meet ANSI C82.11 maximum allowable THD requirements at full output. THD shall at no point in the dimming curve allow imbalance current to exceed full output THD

2.3 DOWNLIGHT

A. Universal mounting bracket.

B. Integral junction box with conduit fittings.

2.4 STRIP LIGHT

A. Integral junction box with conduit fittings.

2.5 SURFACE MOUNT, LINEAR

A. Universal mounting bracket.

B. Integral junction box with conduit fittings.

2.6 SURFACE MOUNT, NONLINEAR

A. Universal mounting bracket.

B. Integral junction box with conduit fittings.

2.7 SUSPENDED, LINEAR

A. Ceiling mounted with two 5/32-inch diameter aircraft cable supports adjustable to 120 inches in length.

2.8 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:

1. Tempered Fresnel glass, prismatic glass or prismatic acrylic, refer to light fixture schedule**.**
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
4. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

D. Housings:

1. Extruded-aluminum housing and heat sink or as noted on light fixture schedule.
2. Powder-coat finish.

E. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage, and coating.
c. CCT and CRI for all luminaires.

2.9 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.10 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish shall match luminaire.

C. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation.

C. Examine walls, floors, roofs, and ceilings for suitable conditions where luminaires will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Coordinate layout and installation of luminaires and suspension system with other construction that penetrates ceilings or is supported by them.

D. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.

E. Ceiling-Grid-Mounted Luminaire Supports: Use grid as a support element.

1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each luminaire. Locate not more than 6 inches from luminaire corners.
2. Support Clips: Fasten to luminaires and to ceiling grid members at or near each luminaire corner with clips that are UL listed for the application.
3. Luminaires of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support luminaires independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
4. Install at least one independent support rod or wire from structure to a tab on luminaire. Wire or rod shall have breaking strength of the luminaire weight at a safety factor of 3.

F. Flush-Mounted Luminaire Support:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

G. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls, or a minimum 20 gauge backing plate attached to wall structural members, or using through bolts and backing plates on either side of wall.
2. Do not attach luminaires directly to gypsum board.

H. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and [tubing or rod for suspension for each unit length of luminaire chassis, including one at each end.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

I. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

B. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

C. Luminaire will be considered defective if it does not pass operation tests and inspections.

D. Prepare test and inspection reports.

3.6 STARTUP SERVICE

A. Burn-in all HID lamps that require specific aging period to operate properly, prior to occupancy by Owner.

3.7 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

SECTION 265116 - INTERIOR LIGHTING

END OF SECTION 265116

SECTION 265219 - EMERGENCY AND EXIT LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Emergency lighting units.
2. Exit signs.
3. Luminaire supports.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Emergency Lighting Unit: A lighting unit with internal or external emergency battery powered supply and the means for controlling and charging the battery and unit operation.

D. Fixture: See "Luminaire" Paragraph.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of emergency lighting unit, exit sign, and emergency lighting support.

1. Include data on features, accessories, and finishes.
2. Include physical description of the unit and dimensions.
3. Battery and charger for light units.
4. Include life, output of luminaire (lumens, CCT, and CRI), and energy-efficiency data.
5. Include photometric data and adjustment factors based on laboratory tests, complying with IES LM-45, for each luminaire type.

a. Testing Agency Certified Data: For indicated luminaires and signs, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires and signs shall be certified by manufacturer.

b. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, and required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Product Schedule:

1. For emergency lighting units. Use same designations indicated on Drawings.
2. For exit signs. Use same designations indicated on Drawings.

D. Qualification Data: For testing laboratory providing photometric data for luminaires.

E. Product Certificates: For each type of luminaire.

F. Product Test Reports: For each luminaire for tests performed by manufacturer and witnessed by a qualified testing agency.

G. Sample Warranty: For manufacturer’s special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Luminaire-mounted, emergency battery pack: One for every 20 emergency lighting units. Furnish at least one of each type.
2. Diffusers and Lenses: two for every 100 of each type and rating installed. Furnish at least one of each type.

1.7 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.9 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace (materials and labor) components of luminaires that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two year(s) from date of Substantial Completion.

B. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Power Unit Batteries: **5** years from date of Substantial Completion. Full warranty shall apply for first year and prorated warranty for the remaining four years.
2. Warranty Period for Emergency Fluorescent Ballast and Self-Powered Exit Sign Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for first year and prorated warranty for the remaining six year**s**.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.

C. Comply with NFPA 70 and NFPA 101.

D. Comply with NEMA LE 4 for recessed luminaires.

E. Comply with UL 1598 for fluorescent luminaires.

F. Lamp Base: Comply with ANSI C81.61 or IEC 60061-1.

G. Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body and compatible with ballast.

1. Emergency Connection: Operate two lamp(s) continuously at an output of 1100 lumens each upon loss of normal power. Connect unswitched circuit to battery-inverter unit and switched circuit to luminaire ballast.
2. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
3. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

    a. Ambient Temperature: Less than 0 deg F or exceeding 104 deg F, with an average value exceeding 95 deg F over a 24-hour period.
    b. Ambient Storage Temperature: Not less than minus 4 deg F and not exceeding 140 deg F.
    c. Humidity: More than 95 percent (condensing).
    d. Altitude: Exceeding 3300 feet.
4. Test Push-Button and Indicator Light: Visible and accessible without opening luminaire or entering ceiling space.

    a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

5. Battery: Sealed, maintenance-free, nickel-cadmium type.
6. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
7. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

H. External Type: Self-contained, modular, battery-inverter unit, suitable for powering one or more lamps, remote mounted from luminaire.

1. Emergency Connection: Operate fluorescent or LED lamp continuously. Connect unswitched circuit to battery-inverter unit and switched circuit to luminaire ballast.
2. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
3. Battery: Sealed, maintenance-free, nickel-cadmium type.
4. Charger: Fully automatic, solid-state, constant-current type.

5. Housing: NEMA 250, Type 1 enclosure listed for installation inside, on top of, or remote from luminaire. Remote assembly shall be located no less than half the distance recommended by the ballast/emergency power unit manufacturer, whichever is less.
6. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
7. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
8. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.2 EMERGENCY LIGHTING

A. General Requirements for Emergency Lighting Units: Self-contained units.

B. Emergency Luminaires:

1. Emergency Luminaires: as indicated on Drawings, with the following additional features:
   a. Rated for installation in damp locations, and for sealed and gasketed luminaires in wet locations.

C. Emergency Lighting Unit:

1. Emergency Lighting Unit: as indicated on Drawings.
2. Wall with universal junction box adaptor.
3. UV stable thermoplastic housing, rated for damp locations.

D. Remote Emergency Lighting Units:

1. Emergency Lighting Unit: as indicated on Drawings.
2. Wall with universal junction box adaptor.
3. UV stable thermoplastic housing, rated for damp locations.
4. External emergency power unit.

2.3 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:
1. Lamps for AC Operation: Fluorescent, two for each luminaire; 20,000 hours of rated lamp life.
2. Lamps for AC Operation: LEDs; 50,000 hours minimum rated lamp life.
3. Self-Powered Exit Signs (Battery Type): Internal emergency power unit.

2.4 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access:

1. Smooth operating, free of light leakage under operating conditions.
2. Designed to permit relamping without use of tools.
3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:
1. Glass: Annealed crystal glass unless otherwise indicated.
2. Acrylic: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

D. Housings:
1. Powder coat finish.

2.5 METAL FINISHES

A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Support Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, and 12 gage.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for conditions affecting performance of luminaires.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Examine walls, floors, roofs, and ceilings for suitable conditions where emergency lighting luminaires will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire and emergency power unit weight.
2. Able to maintain luminaire position when testing emergency power unit.
3. Provide support for luminaire and emergency power unit without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire and emergency power unit weight and vertical force of 400 percent of luminaire weight.

E. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls, or a minimum 20 gauge backing plate attached to wall structural members, or using through bolts and backing plates on either side of wall.
2. Do not attach luminaires directly to gypsum board.

F. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of luminaire chassis, including one at each end.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

G. Ceiling Grid Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure emergency power unit using approved fasteners in a minimum of four locations, spaced near corners of emergency power unit.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

3.5 STARTUP SERVICE

A. Perform startup service:
1. Charge emergency power units and batteries minimum of 24 hours and conduct one-hour discharge test.

3.6 ADJUSTING

A. Adjustments: Within 12 months of date of Substantial Completion, provide on-site visit to do the following:

1. Inspect all luminaires. Replace lamps, emergency power units, batteries, signs, or luminaires that are defective.

a. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

2. Conduct short-duration tests on all emergency lighting.

END OF SECTION 265219

SECTION 265621 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.

B. Related Requirements:

   1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color rendering index.

C. Fixture: See "Luminaire."

D. Lumen: Measured output of lamp and luminaire, or both.

E. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of luminaire.

   1. Arrange in order of luminaire designation.
   2. Include data on features, accessories, and finishes.
   3. Include physical description and dimensions of the luminaires.
   4. Photometric data and adjustment factors based on laboratory tests, complying with IES "Lighting Measurements Testing and Calculation Guides," of each luminaire type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the luminaire as applied in this Project.
      For LED luminaires the adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project IES LM-79 and IES LM-80.

a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.
b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

5. Photoelectric relays.
6. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, and required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Include diagrams for power, signal, and control wiring.

D. Samples: For products designated for sample submission in the Exterior Lighting Fixture Schedule.

E. Samples for Initial Selection: For each type of luminaire with custom, factory-applied finish.

1. Include Samples of luminaires and accessories involving color and finish selection.

F. Samples for Verification: For each type of luminaire.

1. Include Samples of luminaires and accessories to verify finish selection.
2. Lamps and ballasts, installed.
3. Cords and plugs.
4. Support system.

G. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Luminaires.
2. Structural members to which equipment and luminaires will be attached.
3. Underground utilities and structures.
4. Existing underground utilities and structures.
5. Above-grade utilities and structures.
6. Existing above grade utilities and structures.
7. Building features.
8. Vertical and horizontal information.

B. Qualification Data: For testing laboratory providing photometric data for luminaires.

C. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.

E. Sample warranty.

1.6 PRIOR APPROVAL SUBMITTAL REQUESTS

A. Full submittal data , by type, clearly highlighted and arrowed to identify the specific proposed manufacturer's nomenclature

B. Full submittal data of lamp and proposed manufacturer.

C. Full submittal data of driver data of proposed manufacturer

D. LED lumen data will include
   1. Lumen output
   2. L70 and L90 testing
   3. Confirmation of independent test lab data ITL
   4. Color temperature and CRI with quantity of McAdam Ellipse steps
      a. Data shall include sphere and goniometer results for total lumen, total power, luminaire efficacy, CRI and junction temperature for the specified color temperature
   5. Make and brand of LED diode should be clearly identified on submittal data

E. LED dimming shall be equal in range and quality to the specified drivers, Quality of dimming to be defined by dimming range, freedom from perceived flicker or visible stroboscopic flicker, smooth and continuous change in level (no visible steps in transitions), natural square law response to control input, and stable when input voltage conditions fluctuate over what is typically experience in a commercial environment.

F. All substitutions must meet specified fixtures certifications (UL,ETL,CE,CSA, RoHS, DLC, Energy Star)

G. Provide lighting calculations with the prior approval request based on reflectance values and light loss factors provided by the engineer and displayed on lighting calculation drawings. (may be unique by area) Calculations shall be shown on one sheet with dimensions as shown on construction set. Data will be submitted electronically in dxf format on a flash drive and with printed calculations on Architectural E size sheets to scale with construction set sheets.

   1. Discrepancies between prior approval data calculations and the original design calculations will result in immediate disqualification of review due to time based constraints on the bid process

H. Prior approval request may require a sample of both the proposed and specified fixtures provided by the alternate manufacturer at NO additional cost to the project. Samples of both specified and proposed must be provided within 10 working days of request.

I. All data will be submitted electronically and in a bound format

J. Bound data will be secured in hard binder with 3” rings for ease of review or PDF file.

1. Types will be marked with a tab by type and indexed for ease of reference

K. LED warranty information MUST be included by type and marked in RED to clearly identify the manufacturer’s warranty terms. Warranty data MUST meet or exceed the specified manufacturers terms

L. Prior approvals MUST be received and acknowledged to the specifiers office no less than 10 days prior to bid.

M. ALL prior approval data must be submitted in one package with complete information. Information that is incomplete will be rejected without review.

N. The prior approval will be returned marked approved or rejected by type with no explanation. If any specification is deemed not equal the review will be stopped, the type rejected with no explanation.

O. Lumen output for the proposed fixture must be highlighted in yellow for clear identification.

P. All inverter systems supply power to LED fixtures must have pure PWM sine wave function and work with any type of lighting load.

Q. LED warranty information must be included by type and marked in red to clearly identify the manufacturer’s warranty terms. Warranty data must meet or exceed the specified manufacturers terms.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires to include in operation and maintenance manuals.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
2. Glass, Acrylic, and Plastic Lenses, Covers and Other Optical Parts: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.

4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.9 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturers' laboratory accredited under the NVLAP for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products and complying with applicable IES testing standards.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.11 FIELD CONDITIONS

A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.

B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

1.12 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace (labor and material) components of luminaires that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including luminaire support components.
b. Faulty operation of luminaires, ballasts, and accessories.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

B. Warranty Period: Two year(s) from date of Substantial Completion.

A. LED luminaires Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires shall comply with UL 1598 and be listed and labeled for indicated class and division of hazard by an NRTL.

C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

D. Lateral Light Distribution Patterns: Comply with IES RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

E. UL Compliance: Listed for wet location (UL 1598).

F. Lamp base complying with ANSI C81.61 or IEC 60061-1.

G. EMI Filters: Factory installed to suppress conducted EMI as required by MIL-STD-461E. Fabricate luminaires with one filter on each ballast indicated to require a filter.

H. In-line Fusing: Install on the ballast primary for each luminaire.

I. Lamp Rating: Lamp marked for outdoor use and in enclosed locations.

J. Source Limitations: Obtain luminaires from single source from a single manufacturer.

K. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

2.2 LED LIGHTING FIXTURES AND LED LAMPS

A. All LED products must be UL, ETL and/or CSA listed

B. All LED products must have LM-79 and LM-80 testing noted on specification sheet by an independent test lab

C. All LED products should be identified as L70 and/or L90 ratings based on independent test lab data

D. All outdoor and wet location listed products must clearly state the IP rating carried on the fixture based on independent test lab data

E. Bulb shape complying with ANSI C79.1.

F. CRI of Minimum 80. CCT of 4100 K.

G. Rated lamp life of **50,000** hours.

H. Lamps dimmable from 100 percent to 0 percent of maximum light output.

I. Nominal Operating Voltage: as noted on light fixture schedule.

J. All LED products must be serviceable for accessible for field repair needs.

K. All outdoor pole mounted products must have surge suppression within each fixture.

L. All outdoor lighting color rendering should be within a 7 step McAdams Ellipse. All outdoor lighting should be 4000 kelvin unless specifically noted

M. All control systems that interface with an LED product will be supported by a project "integrator" until project completion. This includes contact with the installer prior to installation, availability during installation, and final checkout and startup after installation. The quantity of days required for startup will be based on the manufacturer/agents discretion and need.

1. The project integrator must be capable of performing low voltage and dmx terminations. High voltage terminations are performed solely by the electrical subcontractor.
2. Reporting of final startup completion of the controls system back to the engineer is mandatory.
3. Invitation to attend the training with the owners representative should be made to the engineer no less than 5 days prior to training
4. Signature confirmation of training and startup is required within 5 business days after completion back to the engineer's office.

N. All LED drivers should be capable of 0-10 volt controls and DMX control and shall dim to 1% of total lumen output. Where specifically specified the dimming driver may be required to dim to .1% of lumen output , otherwise known as "dim to dark"

O. Driver manufacturers must have a 5 year history producing dimmable electronic LED drivers for the North American market.

P. Ambient driver temperatures must be within -20 degrees to 50 degrees C (-4 degrees to 122 degrees F)

Q. Driver (internal) must limit inrush current.

1. Base specification: meet or exceed NEMA 410 driver inrush standard of 430 amp per 10 amps load with a maximum of 370 amps/2 seconds
2. Preferred specification : Meet or exceed 30ma's at 277 VAC for up to 50 watts of load and 75A at 240us att 277 VAC for 100 watts of load
3. Withstand up to a 1,000 volt surge without impairment of performance as defined by ANSI C62.41 Category A
4. No visible change in light output with a variation of plus/minus 10percent line voltage input.
5. Total harmonic distortion less than 20%, and meet ANSI C82.11 maximum allowable THD requirements at full output. THD shall at no point in the dimming curve allow imbalance current to exceed full output THD

2.3 LUMINAIRE TYPES - see light fixture schedule on plans

2.4 MATERIALS

A. Metal Parts: Free of burrs and sharp corners and edges.

B. Sheet Metal Components: Corrosion-resistant aluminum or Stainless steel unless otherwise indicated. Form and support to prevent warping and sagging.

C. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Ballast shall automatically disconnect ballast when door opens.

E. Exposed Hardware Material: Stainless steel.

F. Diffusers and Globes:

1. Acrylic Diffusers: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

G. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

H. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

I. Housings:

1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
2. Provide filter/breather for enclosed luminaires.

J. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY," including specific lamp type.
b. Lamp type, wattage, bulb type, and coating (clear or coated) for HID luminaires.

c. ANSI ballast type (M98, M57, etc.) for HID luminaires.
d. CCT and CRI for all luminaires.

2.5 METAL FINISHES

A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

C. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.
3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker), complying with AAMA 611.
4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.

C. Examine walls, roofs, and canopy ceilings and overhang ceilings for suitable conditions where luminaires will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Comply with NECA 1.

B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Install lamps in each luminaire.

D. Remote Mounting of Ballasts: Distance between the ballast and luminaire shall not exceed that recommended by ballast manufacturer. Verify the following with ballast manufacturer:

1. Maximum distance between ballast and luminaire.
2. Wire size between ballast and luminaire.

E. Wiring Method: Install cables in raceways. Conceal raceway and cables.

F. Fasten luminaire to indicate structural supports.

G. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Support luminaires without causing deflection of finished surface.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

H. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls, or a minimum 1/8-inch backing plate attached to wall structural members or using through bolts and backing plates on either side of wall.

I. Install luminaires level, plumb, and square with finished grade unless otherwise indicated. Install luminaires at height indicated on Drawings.

J. Coordinate layout and installation of luminaires with other construction. Refer to architectural elevations prior to rough-ins.

K. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

L. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 260533 "Raceways and Boxes for Electrical Systems;" for wiring connections and wiring methods.

3.4 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.5 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.6 FIELD QUALITY CONTROL

A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Photoelectric Control Operation: Verify operation of photoelectric controls.

C. Illumination Tests:

1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IES testing guide(s):

a. IES LM-5.
b. IES LM-50.
c. IES LM-52.
d. IES LM-64.
e. IES LM-72.

D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain luminaires and photocell relays.

3.8 STARTUP SERVICE

A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Owner.

3.9 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION 265621

PART 1 - GENERAL

1.1 SUMMARY

A. Provide an addressable control panel with manual and automatic initiation devices plus 100% expansion in the future and associated raceways and power connection for power supplies for a complete installation. Indicating devices shall also be provided to comply with TDLR. Including with all hardware/components necessary for an IP and cellular alarm communications.

B. Fully coordinate with the Fire Sprinkler System Tamper and Flow Switches for the Fire Alarm interfacing.

C. Fully coordinate with the HVAC contractor for the Fire Alarm HVAC equipment (over 2,000 cfm's) duct smoke detectors interfacing.

D. Related Sections: The following Sections contain requirements that relate to this Section:

1. HVAC Controls - "Electric Control Systems for duct smoke detectors. HVAC down relay. (AHU shut down relay furnished by Fire Alarm Contractor).

E. Definitions:

1. FACP: Fire alarm control panel.
2. LED: Light-emitting diode.
3. Definitions in NFPA 72 apply to fire alarm terms used in this Section.

F. System Description:

1. Noncoded, addressable system; multiplexed signal transmission dedicated to fire alarm service only.

G. Performance Requirements:

1. Comply with NFPA 72.
2. Fire alarm signal initiation shall be by one or more of the following devices:

    a. Manual stations.
    b. Heat detectors.
    c. Smoke detectors.
    d. Verified automatic alarm operation of smoke detectors.
    e. Automatic sprinkler system water flow.
    f. Fire extinguishing system operation.

3. Fire alarm signal shall initiate the following actions:

    a. Visual notification appliances shall operate continuously.
    b. Identify alarm at the FACP and remote annunciators.
    c. Audible notification appliances shall operate continuously until silenced.
    d. Visual notification appliances shall continue to operate until reset.

e. Switch heating, ventilating, and air-conditioning equipment controls to fire alarm mode.
f. Release fire and smoke doors held open by magnetic door holders.
g. Transmit an alarm signal to the remote alarm receiving station
h. Record events in the system memory.

4. Supervisory signal initiation shall be by one or more of the following devices or actions:

a. Operation of a fire-protection system valve tamper.
b. Operation of a fire-protection system valve flow.

5. System trouble signal initiation shall be (per building) by one or more of the following devices or actions:

a. Open circuits, shorts and grounds of wiring for initiating device, signaling line, and notification-appliance circuits.
b. Opening, tampering, or removal of alarm-initiating and supervisory signal-initiating devices.
c. Loss of primary power at the FACP.
d. Ground or a single break in FACP internal circuits.
e. Abnormal ac voltage at the FACP.
f. A break in standby battery circuitry.
g. Failure of battery charging.
h. Abnormal position of any switch at the FACP or annunciator.
i. Fire-pump power failure, including a dead-phase or phase-reversal condition.

6. System Trouble and Supervisory Signal Actions: Ring trouble bell and annunciate at the FACP and remote annunciators. Record event.

H. AHU SHUT DOWN

1. When a fire alarm condition is detected by AHU duct smoke detector and reported, the following functions shall immediately occur:

a. The system alarm LED on the FACP shall flash.
b. A local piezo electric signal in the control panel shall sound.
c. A backlit 80-character LCD display on the FACP shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
d. This particular AHU shall be shut down only; the remaining AHU’s shall remain operational.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. System Operation Description: Detailed description for this Project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.
2. Device Address List: Coordinate with final system programming.
3. System riser diagram with device addresses, conduit sizes, and cable and wire types and sizes.
4. Wiring Diagrams: Power, signal, and control wiring. Include diagrams for equipment and for system with all terminals and interconnections identified. Show wiring color code.
5. Batteries: Size calculations.

C. Field quality-control test reports.

D. Operation and maintenance data.

E. Submittals to Authorities Having Jurisdiction: In addition to distribution requirements for submittals specified in Division 1 Section "Submittals," make an identical submittal to authorities having jurisdiction. To facilitate review, include copies of annotated Contract Drawings as needed to depict component locations. Resubmit if required to make clarifications or revisions to obtain approval. On receipt of comments from authorities having jurisdiction, submit them to Architect for review.

F. Documentation:

1. Approval and Acceptance: Provide the "Record of Completion" form according to NFPA 72 to Owner, Architect, and authorities having jurisdiction.
2. Record of Completion Documents: Provide the "Permanent Records" according to NFPA 72 to Owner, Architect, and authorities having jurisdiction. Format of the written sequence of operation shall be the optional input/output matrix.

    a. Hard copies on paper to Owner, Architect, and authorities having jurisdiction.
    b. Electronic media may be provided to Architect and authorities having jurisdiction.

1.3 QUALITY ASSURANCE

A. Installer Qualifications:
1. Installer shall provide proof of their qualifications as Factory Authorized and Factory Trained for the product(s) specified herein. These documents shall be included in the submittal package. A letter from the manufacturer stating that the Contractor is the Factory Authorized Distributor for the submitted equipment shall be included in the submittal package.
2. The installing Contractor (Company) shall have completed a minimum of five projects of similar size and scope within the past five years. Provide a list of completed projects to include names and phone numbers of the Owner's representative and the General Contractor for the project.
3. Contractor Personnel Requirements:
    a. One full time employee with a current Texas Fire Alarm Planning Superintendents License.
    b. One full time employee with NICET Level III certification.

c. A minimum of two technicians with Factory Training for the submitted product(s). Copies of License, NICET Certification, and Factory Training shall be included in the submittals.
d. The installation shall be performed by licensed full time employees of the Factory Authorized Distributor.

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.

C. A factory-authorized Installer is to perform the Work of this Section. Installer is to be licensed by Texas Commission on Fire Protection as Fire Alarm Technician or Fire Alarm Planning Superintendent. Texas Commission on Fire Protection shall license installing company. Provide copies of licensing with submittal.

D. Compliance with Local Requirements: Comply with the applicable building code, local ordinances, and regulations, and the requirements of the authority having jurisdiction.

E. Comply with Article 5.43-2 Insurance code and fire alarm rules as required by Texas Commission on Fire Protection.

F. Comply with Article 5.43-2 Insurance code and fire alarm rules as required by Texas Commission on Fire Protection.

G. NFPA Compliance: Provide fire alarm and detection systems conforming to the requirements of the following publications:

1. NFPA 72, "Installation, Maintenance, and Use of Protective Signaling Systems."
2. NFPA 72E, "Automatic Fire Detectors."
3. NFPA 72G, "Guide for the Installation, Maintenance and Use of Notification Appliances for Protective Signaling Systems."

H. NRTL Listing: Provide systems and equipment that are listed and labeled.
1. Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

I. UL Compliance: All devices are to be UL listed for Fire, Security, and Access Control.

J. Single-Source Responsibility: Obtain fire alarm components from a single source who assumes responsibility for compatibility for system components.

1.4 WARRANTY

A. Guarantee all labor and equipment furnished under this bid package for a period of five (5) years commencing from the date of final system acceptance, including annual inspections of the system.

B. During the warranty period report to the site and repair or replace any defective materials or workmanship without cost to the Owner. Warranty service shall be rendered within 24 hours

after request by Owner. Equivalent replacement equipment shall be temporarily provided when immediate on-site repairs cannot be made.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. FACP with voice evacuation and Equipment:

    a. Silent Knight 5820XL

2. Wire and Cable:

    a. Comtran Corporation.
    b. Helix/HiTemp Cables, Inc.; a Draka USA Company.
    c. Rockbestos-Suprenant Cable Corporation; a Marmon Group Company.
    d. West Penn Wire/CDT; a division of Cable Design Technologies.

3. Audible and Visual Signals:

    a. Edwards Systems Technology Inc.
    b. Commercial Products Group.
    c. Gentex Corporation.
    d. System Sensor; a GE-Honeywell Company.

2.2 FACP

A. General Description:

1. Modular, power-limited design with electronic modules, UL 864 listed.
2. Addressable control circuits for operation of mechanical equipment.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at the FACP and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, three line(s) of 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

C. Circuits:

1. Signaling Line Circuits: NFPA 72, Class B, Style 4.

    a. System Layout: Install no more than 100 addressable devices on each signaling line circuit.

2. Notification-Appliance Circuits: NFPA 72, Class A, Style Z.
3. Notification-Appliance Circuits: NFPA 72, Class B, Style Y.
4. Actuation of alarm notification appliances, emergency voice communications, annunciation, elevator recall, and actuation of suppression systems shall occur within 10 seconds after the activation of an initiating device.
5. Electrical monitoring for the integrity of wiring external to the FACP for mechanical equipment shutdown and magnetic door-holding circuits is not required, provided a break in the circuit will cause doors to close and mechanical equipment to shut down.

D. Smoke-Alarm Verification:

1. Initiate audible and visible indication of an "alarm verification" signal at the FACP.
2. Activate a listed and approved "alarm verification" sequence at the FACP and the detector.
3. Record events.
4. Sound general alarm if the alarm is verified.
5. Cancel FACP indication and system reset if the alarm is not verified.

E. Notification-Appliance Circuit: Operation shall sound in a temporal pattern, complying with ANSI S3.41 [120 beats per minute, march-time pattern].

F. Power Supply for Supervision Equipment: Supply for audible and visual equipment for supervision of the ac power shall be from a dedicated dc power supply, and power for the dc component shall be from the ac supply.

G. Alarm Silencing, Trouble, and Supervisory Alarm Reset: Manual reset at the FACP and remote annunciators, after initiating devices are restored to normal.

1. Silencing-switch operation halts alarm operation of notification appliances and activates an "alarm silence" light. Display of identity of the alarm zone or device is retained.
2. Subsequent alarm signals from other devices or zones reactivate notification appliances until silencing switch is operated again.
3. When alarm-initiating devices return to normal and system reset switch is operated, notification appliances operate again until alarm silence switch is reset.

H. Walk Test: A test mode to allow one person to test alarm and supervisory features of initiating devices. Enabling of this mode shall require the entry of a password. The FACP and annunciators shall display a test indication while the test is underway. If testing ceases while in walk-test mode, after a preset delay, the system shall automatically return to normal.

I. Transmission to Remote Alarm Receiving Station: Provide and install IPGSM cellular communicator by Honeywell and provide monitoring for 1 year. Automatically transmit alarm, trouble, and supervisory signals to a remote alarm station through this cellular communicator.

J. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signal, supervisory signal supervisory and digital alarm communicator transmitter shall be powered by the 24-V dc source.

1. The alarm current draw of the entire fire alarm system shall not exceed 80 percent of the power-supply module rating.

2. Power supply shall have a dedicated fused safety switch for this connection at the service entrance equipment. Paint the switch box red and identify it with "FIRE ALARM SYSTEM POWER."

K. Secondary Power: 24-V dc supply system with batteries and automatic battery charger and an automatic transfer switch.

1. Batteries: Sealed Lead-Acid, or Absorbed Glass Mat.
2. Battery and Charger Capacity: Comply with NFPA 72.

L. Surge Protection:

1. Install surge protection on normal ac power for the FACP and its accessories. Comply with Division 16 Section "Transient Voltage Suppression" for auxiliary panel suppressors.
2. Install surge protectors recommended by FACP manufacturer. Install on all system wiring external to the building housing the FACP.

M. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

N. The fire alarm control panel shall have the capability to support remote monitoring and control via LAN, WAN or Internet connection to a remote graphics workstation in real time.

2.3 MANUAL FIRE ALARM BOXES

A. Description: UL 38 listed; finished in red with molded, raised-letter operating instructions in contrasting color. Station shall show visible indication of operation. Mounted on recessed outlet box; if indicated as surface mounted, provide manufacturer's surface back box.
1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type. With integral addressable module, arranged to communicate manual-station status (normal, alarm, or trouble) to the FACP.
2. Station Reset: Key- or wrench-operated switch.
3. Provide all manual stations with STI 1100 protective cover.

2.4 SYSTEM SMOKE DETECTORS

A. General Description:

1. UL 268 listed, operating at 24-V dc, nominal.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
3. Multipurpose type, containing the following:

a. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
b. Heat sensor, combination rate-of-rise and fixed temperature.

4. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. Provide terminals in the fixed base for connection of building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type. Indicating detector has operated and power-on status.

B. Photoelectric Smoke Detectors:

1. Sensor: LED or infrared light source with matching silicon-cell receiver.
2. Detector Sensitivity: Between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.

C. Duct Smoke Detectors:

1. Photoelectric Smoke Detectors:

    a. Sensor: LED or infrared light source with matching silicon-cell receiver.
    b. Detector Sensitivity: Between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.

2. UL 268A listed, operating at 24-V dc, nominal.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
4. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. The fixed base shall be designed for mounting directly to the air duct. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type. Indicating detector has operated status. Provide remote status and alarm indicator and test station where indicated.
7. Sampling Tubes: Design and dimensions as recommended by manufacturer for the specific duct size, air velocity, and installation conditions where applied.
8. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

D. Single-Station Duct Detectors:

1. UL 268A listed, operating at 120-V ac.
2. Sensor: LED or infrared light source with matching silicon-cell receiver.

    a. Detector Sensitivity: Between 2.5 and 3.5 percent/foot smoke obscuration when tested according to UL 268A.

3. Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. The fixed base shall be designed for mounting directly to the air duct. Provide terminals in the fixed base for connection to building wiring.
4. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.

5. Integral Visual-Indicating Light: LED type. Indicating detector has operated status. Provide remote status and alarm indicator and test station where indicated.
6. Sampling Tubes: Design and dimensions as recommended by manufacturer for the specific duct size, air velocity, and installation conditions where applied.
7. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.5 HEAT DETECTORS

A. General: UL 521 listed.

B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or rate-of-rise of temperature that exceeds 15 deg F per minute, unless otherwise indicated.

1. Mounting: Plug-in base, interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F.

1. Mounting: Plug-in base, interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

2.6 NOTIFICATION APPLIANCES

A. Description: Equipped for mounting as indicated and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly.

2. All appliances that are supplied for the requirements of this specification shall be UL Listed for Fire Protective Service, and shall be capable of providing the "equivalent facilitation" which is allowed under the Americans with Disabilities Act Accessibilities Guidelines (ADAAG)), and shall be UL 1971 Listed.

3. All appliances shall be of the same manufacturer as the fire alarm control panel specified to insure absolute compatibility between the appliances and the control panels, and to insure that the application of the appliances are done in accordance with the single manufacturer's instructions.

4. Any appliances that do not meet the above requirements, and are submitted for use must show written proof of their compatibility for the purpose intended. Such proof shall be in the form of documentation from all manufacturers that clearly states that their equipment (as submitted) is 100% compatible with each other for the purpose intended. All strobes shall be provided with lens markings oriented for wall mounting.

5. Notification appliances shall be synchronized in hallways and in any area where two more appliances are visible.

6. All notification appliances shall be white unless noted otherwise on the drawings.

B. Low Profile Horns: Provide low profile wall mount horns at the locations shown on the drawings. The horn shall provide an 84-dBA sound output at 10 ft. when measured in reverberation room per UL-464. The horn shall have a selectable steady or synchronized temporal output. In and out screw terminals shall be provided for wiring. The horn shall mount in a North American 1-gang box.

C. Low Profile Strobes Horns: Provide low profile wall mount horn/strobes at the locations shown on the drawings. The horn/strobe shall provide an audible output of 84 dBA at 10 ft. when measured in reverberation room per UL-464. Strobes shall provide synchronized flash outputs. The strobe output shall be determined as required by its specific location and application from a family of 15cd, 30cd, 60cd, 75cd & 110cd devices. The horn shall have a selectable steady or synchronized temporal output. In and out screw terminals shall be provided for wiring. Low profile horn/strobes shall mount in a North American 1-gang box.

D. Low profile strobes: Xenon strobe lights listed under UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.

1. Rated Light Output: 75 110 candela or as noted on plans.
2. Strobe Leads: Factory connected to screw terminals.

2.7 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching door plate.

1. Electromagnet: Requires no more than 3 W to develop 25-lbf (111-N) holding force.
2. Wall-Mounted Units: Flush mounted, unless otherwise indicated.
3. Rating: 120-V ac.

B. Material and Finish: Match door hardware.

2.8 REMOTE ANNUNCIATOR

A. Description: Duplicate annunciator functions of the FACP for alarm, supervisory, and trouble indications. Also duplicate manual switching functions of the FACP, including acknowledging, silencing, resetting, and testing.

1. Mounting: Flush cabinet, NEMA 250, Class 1.

B. Display Type and Functional Performance: Alphanumeric display same as the FACP. Controls with associated LEDs permit acknowledging, silencing, resetting, and testing functions for alarm, supervisory, and trouble signals identical to those in the FACP.

2.9 ADDRESSABLE INTERFACE DEVICE

A. Description: Microelectronic monitor module listed for use in providing a system address for listed alarm-initiating devices for wired applications with normally open contacts.

B. Integral Relay: Capable of providing a direct signal [to the elevator controller to initiate elevator recall] [to a circuit-breaker shunt trip for power shutdown] <Insert other functions>.

2.10 IP FIRE ALARM COMMUNICATOR TRANSMITTER

A. UL 864 listed for signaling under Other Transmission Technologies and comply with NFPA 72 requirements

B. Metal enclosure to mount next to a UL listed fire alarm control panel.

C. Two supervised inputs and two additional outputs.

D. Functional Performance: Unit receives an alarm, supervisory, or trouble signal from the FACP, and automatically captures the cellular alarm communicator (Telguard TG-7) dials a preset number for a remote central station.

E. Supports both dynamic (DHCP) or Public and Private Static IP address.

F. Supports dual-destination IP receiver address for high redundancy configurations.

G. RJ45X Ethernet Termination

H. Silent Knight SK-IP

2.11 CELLULAR ALARM COMMUNICATOR FOR 3G/4G NETWORKS

A. UL Listings 864

B. Full data reporting

C. Automatic self-test

D. Locking metal enclosure

E. Telguard TG-7

2.12 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Listed and labeled according to UL 632.

B. Functional Performance: Unit receives an alarm, supervisory, or trouble signal from the FACP, and automatically captures one or two telephone lines and dials a preset number for a remote central station. When contact is made with the central station(s), the signal is transmitted. The unit supervises up to two telephone lines. Where supervising 2 lines, if service on either line is

interrupted for longer than 45 seconds, the unit initiates a local trouble signal and transmits a signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. When telephone service is restored, unit automatically reports that event to the central station. If service is lost on both telephone lines, the local trouble signal is initiated.

C. Secondary Power: Integral rechargeable battery and automatic charger. Battery capacity is adequate to comply with NFPA 72 requirements.

D. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.13 WIRE AND CABLE

A. Wire and cable for fire alarm systems shall be UL listed and labeled as complying with NFPA 70, Article 760.

B. Signaling Line Circuits: Twisted, shielded pair, not less than No. 18 AWG size as recommended by system manufacturer.

1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70 Article 760, Classification CI, for power-limited fire alarm signal service. UL listed as Type FPL, and complying with requirements in UL 1424 and in UL 2196 for a 2-hour rating.

C. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.

1. Low-Voltage Circuits: No. 16 AWG, minimum.
2. Line-Voltage Circuits: No. 12 AWG, minimum.

D. Underground cabling: Please provide water resistant/water blocking type, equal to West Penn “Aquaseal”.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Connecting to Existing Equipment: Verify that existing fire alarm system is operational before making changes or connections.

1. Connect new equipment to the existing control panel in the existing part of the building.
2. Expand, modify, and supplement the existing control equipment as necessary to extend the existing control functions to the new points. New components shall be capable of merging with the existing configuration without degrading the performance of either system.

B. Smoke or Heat Detector Spacing:

1. Smooth ceiling spacing shall not exceed the rating of the detector.
2. Spacing of heat detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas, shall be determined according to Appendix A in NFPA 72.

3. Spacing of heat detectors shall be determined based on guidelines and recommendations in NFPA 72.

C. HVAC: Locate detectors not closer than 3 feet from air-supply diffuser or return-air opening.

D. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of the duct.

E. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.

F. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

G. Audible Alarm-Indicating Devices: Install not less than 80 inches above the finished floor nor less than 6 inches below the ceiling whichever is lower.

H. Visual Alarm-Indicating Devices: Install as shown and not less than 80 inches above the finished floor or 6 inches below the ceiling whichever is lower.

I. Device Location-Indicating Lights: Locate in public space near the device they monitor.

J. FACP: Flush mount with tops of cabinets not more than 72 inches above the finished floor.

K. Annunciator: Install with top of panel not more than 72 inches above the finished floor.

L. Manual Pull Stations: Mount semi-flush in recessed back boxes with operating handles 48 inches above finished floor or as indicated.

3.2 WIRING INSTALLATION

A. Wiring Method: Install wiring in metal raceway according to Division 26 Section "Raceways and Boxes for Electrical Systems."

1. NECA 1.
2. TIA/EIA 568-A.
3. Public areas with exposed structure, all wiring shall be concealed in raceway.
4. Stub up raceways into accessible ceiling space.
5. Install wiring in raceways except in accessible indoor ceiling spaces. Secure wiring from building structure steel (no walls) by means of J-hooks. Where available lay out cables in cable tray.
6. Conceal raceways and wiring except in unfinished spaces and as indicated.
7. Minimum conduit size shall be 1/2 inch. Control and data transmission wiring shall not share conduit with other building wiring systems.
8. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.

B. Wiring Method: Install wiring in metal raceway according to Division 26 Section "Raceways and Boxes for Electrical Systems."

1. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.

C. Wiring Method:

1. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
2. Fire-Rated Cables: Use of 2-hour fire-rated fire alarm cables, NFPA 70 Types MI and CI, is not permitted.
3. Signaling Line Circuits: Power-limited fire alarm cables may be installed in the same cable or raceway as signaling line circuits.

D. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

E. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

F. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

G. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the FACP and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals according to Division 16 Section “Electrical Identification."

B. Install instructions frame in a location visible from the FACP.

C. Paint power-supply disconnect switch red and label "FIRE ALARM."

3.4 GROUNDING

A. Ground the FACP and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to the FACP.

3.5 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Before requesting final approval of the installation, submit a written statement using the form for Record of Completion shown in NFPA 72.
2. Perform each electrical test and visual and mechanical inspection listed in NFPA 72. Certify compliance with test parameters.
3. Visual Inspection: Conduct a visual inspection before any testing. Use as-built drawings and system documentation for the inspection. Identify improperly located, damaged, or nonfunctional equipment, and correct before beginning tests.
4. Testing: Follow procedure and record results complying with requirements in NFPA 72.

    a. Detectors that are outside their marked sensitivity range shall be replaced.

5. Test and Inspection Records: Prepare according to NFPA 72, including demonstration of sequences of operation by using the matrix-style form in Appendix A in NFPA 70.

3.6 MONITORING

A. Include in bid proposal the cost for 1 year remote monitoring. Monitoring station shall UL listed and 24 hour 365 days operation.

3.7 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project outside normal occupancy hours for this purpose.

B. Semiannual Test and Inspection: Six months after date of Substantial Completion and for the following three years, test the fire alarm system complying with the testing and visual inspection requirements in NFPA 72. Perform tests and inspections listed for monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the fire alarm system, appliances, and devices. Refer to Division 1 Section "Closeout Procedures."

END OF SECTION 267210

SECTION 267240 - INTRUSION DETECTION

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. This document is intended to specify the requirements for the provision of all equipment, materials, labor, documentation and services necessary to furnish and install a complete and operational integrated security access control and alarm monitoring (ACAM) system. The system shall consist of a fully automated and integrated computer-based security system, including, but not limited to the following functions and capabilities:
   a. Security alarm monitoring and reporting of alarm and trouble conditions detected by sensors and/or devices in local and remote locations
   b. Control panel shall be expandable or networked to connect the future buildings.

1.3 DEFINITIONS

A. LCD: Liquid-crystal display.

B. LED: Light-emitting diode.

C. PIR: Passive infrared.

D. RFI: Radio-frequency interference.

E. UPS: Uninterruptible power supply.

F. Protected or Protection Zone: A space or area for which an intrusion must be detected and uniquely identified, the sensor or group of sensors assigned to perform the detection, and any interface equipment between sensors and communication link to central-station control unit.

1.4 SUBMITTALS

A. Product Data: Components for sensing, detecting, and control, including dimensions and data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: Detail assemblies of standard components that are custom assembled for specific application on this Project.

1. Functional Block Diagram: Show single-line interconnections between components including interconnections between components specified in this Section and those furnished under other Sections. Indicate control, signal, and data communication paths. \
2. Raceway Riser Diagrams: Detail raceway runs required for intrusion detection and for systems integration. Include designation of devices connected by raceway, raceway type, and size, and type and size of wire and cable fill for each raceway run.
3. Device Address List: Coordinate with final system programming.
4. System Wiring Diagrams: Include system diagrams unique to Project. Show connections for all devices, components, and auxiliary equipment. Include diagrams for equipment and for system with all terminals and interconnections identified.
5. Details of surge-protection devices and their installation.
6. Sensor detection patterns and adjustment ranges.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For intrusion detection system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:

1. Data for each type of product, including features and operating sequences, both automatic and manual.

E. Warranty: Special warranty specified in this Section.

F. Other Information Submittals:

1. Test Plan and Schedule: Test plan defining all tests required to ensure that system meets technical, operational, and performance specifications.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:
1. Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Intrusion Detection Systems Integrator Qualifications: An experienced intrusion detection equipment supplier who has completed systems integration work for installations similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

C. FMG Compliance: FMG-approved and -labeled intrusion detection devices and equipment.

D. Comply with NFPA 70.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and Installer agree to repair or replace (labor and materials) components of intrusion detection devices and equipment that fails in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

1.7 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. Intrusion Detection Devices: Furnish quantity equal to two percent of the number of units of each type installed, but no less than one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FUNCTIONAL DESCRIPTION OF SYSTEM

A. Supervision: System components shall be continuously monitored for normal, alarm, supervisory**,** and trouble conditions. Indicate deviations from normal conditions at any location in system. Indication includes identification of device or circuit in which deviation has occurred and whether deviation is an alarm or malfunction.

1. Alarm Signal: Display at central-station control unit and actuate audible and visual alarm devices.
2. Trouble Condition Signal: Distinct from other signals, indicating that system is not fully functional. Trouble signal shall indicate system problems such as battery failure, open or shorted transmission line conductors, or controller failure.
3. Supervisory Condition Signal: Distinct from other signals, indicating an abnormal condition as specified for the particular device or controller.

B. System Control: Central-station control unit shall directly monitor intrusion detection units and connecting wiring.

C. System shall automatically reboot program without error or loss of status or alarm data after any system disturbance.

D. Operator Commands:
1. Acknowledge Alarm: To indicate that alarm message has been observed by operator.
2. Place Protected Zone in Access: Disable all intrusion-alarm circuits of a specific protected zone. Tamper circuits may not be disabled by operator.
3. Place Protected Zone in Secure: Activate all intrusion-alarm circuits of a protected zone.
4. Protected Zone Test: Initiate operational test of a specific protected zone.
5. System Test: Initiate system-wide operational test.

E. Circuit Supervision: Supervise all signal and data transmission lines, links with other systems, and sensors from central-station control unit. Indicate circuit and detection device faults with both protected zone and trouble signals, sound a distinctive audible tone, and illuminate an

LED. Maximum permissible elapsed time between occurrence of a trouble condition and indication at central-station control unit is 20 seconds. Initiate an alarm in response to opening, closing, shorting, or grounding of a signal or data transmission line.

F. Programmed Secure-Access Control: System shall be programmable to automatically change status of various combinations of protected zones between secure and access conditions at scheduled times. Status changes may be preset for repetitive, daily, and weekly; specially scheduled operations may be preset up to a year in advance. Manual secure-access control stations shall override programmed settings.

2.3 SYSTEM COMPONENT REQUIREMENTS

A. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor entry connection to components.

1. Minimum Protection for Power Lines 120 V and More: Auxiliary panel suppressors complying with requirements in Division 16 Section "Transient Voltage Suppression."
2. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Lines: Comply with requirements in Division 16 Section "Transient Voltage Suppression" as recommended by manufacturer for type of line being protected.

B. Interference Protection: Components shall be unaffected by radiated RFI and electrical induction of 15 V/m over a frequency range of 10 to 10,000 MHz and conducted interference signals up to 0.25-V RMS injected into power supply lines at 10 to 10,000 MHz.

C. Tamper Protection: Tamper switches on detection devices, controllers, annunciators, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled and when entering conductors are cut or disconnected.

D. Manufacturers:
1. Napco

E. Keypad and Display Module:
1. Arranged for entering and executing commands for system-status changes and for displaying system-status and command-related data.
2. 13 Character Alpha Numeric display.
3. Furnish with STI6560 protective cover with keyed lock.

F. Cellular Communicator:
1. Provide and install Napco Starlink NAP-SLEGSM34GFREE cellular communicator and provide monitoring for 1 year. Automatically transmit alarm, trouble, and supervisory signals to a remote alarm station through this cellular communicator.

2.4 DOOR AND WINDOW SWITCHES

A. Description: Balanced-magnetic switch, complying with UL 634, installed on frame with integral overcurrent device to limit current to 80 percent of switch capacity. Bias magnet and

minimum of two encapsulated reed switches shall resist compromise from introduction of foreign magnetic fields.

B. Flush-Mounted Switches: Unobtrusive and flush with surface of door and window frame.

C. Overhead Door Switch: Balanced-magnetic type, listed for outdoor locations, and having door-mounting magnet and floor-mounting switch unit.

2.5 MICROWAVE-PIR DUAL-TECHNOLOGY MOTION SENSORS

A. Description: Single unit combining a sensor that detects changes in microwave signals and a PIR sensor that detects changes in ambient level of infrared emissions caused by standard-intruder movement within detection pattern.

B. Device Performance: An alarm is transmitted when either sensor detects a standard intruder within a period of three to eight seconds from when the other sensor detects a standard intruder.

1. Minimum Detection Pattern: A room 20 by 30 feet.
2. PIR Sensor Sensitivity: Adjustable pattern coverage to detect a change in temperature of 2 deg F or less, and standard-intruder movement within sensor's detection patterns at any speed between 0.3 to 7.5 fps across 2 adjacent segments of detector's field of view.
3. Microwave Sensor Sensitivity: Adjustable, able to detect standard-intruder movement within sensor's detection pattern at any speed between 0.3 to 7.5 fps. Sensor sensitivity adjustments shall be accessible only when sensor housing is removed, and sensors shall comply with 47 CFR 15.
4. Activation Indicator: LED indicator shall not be visible during normal operation. Indicator shall light when sensor detects a standard intruder. Locate test enabling switch under sensor housing cover.

2.6 ACOUSTIC-TYPE, GLASS-BREAK SENSORS:

A. Detect unique, airborne acoustic energy spectrum caused by breaking glass.

1. Sensor Element: Microprocessor-based, digital device to detect breakage of plate, laminate, tempered, and wired glass while rejecting common causes of false alarms. Detection pattern shall be at least a 20-foot range.
2. Hookup Cable: Factory installed, not less than 72 inches.
3. Activation Indicator: LED on sensor housing that lights when responding to vibrations, remaining on until manually reset at sensor controller or at central-station control unit.
4. Controller: Integral with sensor housing or in a separate assembly, locally adjustable by control under housing cover.

2.7 AUDIBLE AND VISUAL ALARM DEVICES

A. Siren: 30-W speaker with siren driver, rated to produce a minimum sound output of 103 dB at 10 feet from central-station control unit.

1. Enclosure: Weather-resistant steel box with tamper switches on cover and on back of box.

B. Strobe: Xenon light complying with UL 1638, with a clear polycarbonate lens.

1. Light Output: 115 cd, minimum.
2. Flash Rate: 60 per minute.

PART 3 - EXECUTION

3.1 SYSTEM INSTALLATION

A. Comply with UL 681.

3.2 WIRING INSTALLATION

A. Installation: UL 681.

B. Wiring Method: Install wiring in raceways except in accessible indoor ceiling spaces. Secure from building structure steel (no from walls) by means of J-hooks. Conceal raceways and wiring except in unfinished spaces and as indicated. Minimum conduit size shall be 1/2 inch. Control and data transmission wiring shall not share conduit with other building wiring systems.

C. Where available lay out cables in cable tray.

D. Wiring shall not be exposed below ceiling.

E. Raceway system shall comply with Section 16130.

F. Each security device is to have an individual cable from the device to the Control Panel.

G. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer. Install conductors parallel with or at right angles to sides and back of enclosure. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with intrusion system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

H. Wires and Cables:

1. Conductors: Size as recommended in writing by system manufacturer, unless otherwise indicated.
2. 120-V Power Wiring: Install according to Division 16 Section "Conductors and Cables," unless otherwise indicated.
3. Control and Signal Transmission Conductors: Install unshielded, twisted-pair cable, unless otherwise indicated or if manufacturer recommends shielded cable.
4. Provide rated for return open plenum.
5. Underground cabling: Please provide water resistant/water blocking type, equal to West Penn “Aquaseal”.

I. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

J. Install power supplies and other auxiliary components for detection devices at controllers, unless otherwise indicated or required by manufacturer. Do not install such items near devices they serve.

K. Identify components with engraved, laminated-plastic or metal nameplate for central-station control unit and each terminal cabinet, mounted with corrosion-resistant screws. Nameplates and label products are specified in Division 16 Section "Electrical Identification."

3.3 ZONES

A. Each building area shall be zoned by occupancy areas (office area, kitchen, science lab, computer lab, first floor classrooms, second floor classrooms) and interior and exterior zones

3.4 GROUNDING

A. Ground system components and conductor and cable shields to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

B. Signal Ground Terminal: Locate at main equipment rack or cabinet. Isolate from power system and equipment grounding. Provide 5-ohm ground. Measure, record, and report ground resistance.

C. Install grounding electrodes of type, size, location, and quantity indicated. Comply with installation requirements in Division 16 Section "Grounding and Bonding."

3.5 FIELD QUALITY CONTROL

A. Pretesting: After installation, align, adjust, and balance system and perform complete pretesting to determine compliance of system with requirements in the Contract Documents. Correct deficiencies observed in pretesting.

1. Report of Pretesting: After pretesting is complete, provide a letter certifying that installation is complete and fully operable; include names and titles of witnesses to preliminary tests.

B. Perform the following field tests and inspections and prepare reports:

1. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.
2. Operational Tests: Schedule tests after pretesting has been successfully completed. Test all modes of system operation and intrusion detection at each detection device. Test for detection of intrusion and for false alarms in each protected zone. Test for false alarms by simulating activities outside indicated detection patterns.

C. Report of Tests and Inspections: Prepare a written record of tests, inspections, and detailed test results in the form of a test log.

D. Tag all equipment, stations, and other components for which tests have been satisfactorily completed.

3.6 MONITORING

A. Include in bid proposal the cost for 1 year remote monitoring. Monitoring station shall UL listed and 24 hour 365 days operation.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain intrusion detection. Refer to Division 1 Section "Demonstration and Training."

B. Train Owners maintenance personnel on programming equipment for starting up and shutting down, troubleshooting, servicing, and maintaining equipment. Provide a minimum of two 2 hours training.

3.8 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.

END OF SECTION 267240

SECTION 268050 - HAND DRYERS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnishing and installation of electric hand dyers.

1.2 RELATED SECTIONS

B. Basic Electrical Requirements - Section 260100

C. Wire and Cables - Section 260519

D. Grounding and Bonding- Section 260526

E. Raceways and Boxes - Section 260533

1.3 SUBMITTALS

A. First two paragraphs below are defined in Division 01 Section "Submittal Procedures" as "action submittals."

1.4 WARRANTY

A. Provide a 5-year minimum warranty from date of acceptance of project.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Dyson Airblade V – No substitutions

2.2 MINIMUM FEATURES

B. Hand dryer cover shall be a one-piece, heavy-duty, rib-reinforced, die-cast zinc alloy. It shall be lightweight, unbreakable, rustproof and all exposed surfaces shall be bright chrome plated or finished with chip-proof, electrostatically applied epoxy paint and fastened to a wall plate by two chrome plated tamper-proof bolts.

C. Hand dryer wall plate shall be equipped with (3) 7/8" diameter holes, one of which shall be suitable for use with surface conduit, for ease of wiring.
All internal hand dryer parts shall be coated according to Underwriters' Laboratories, Inc. requirements.

D. Entire mechanism shall be internally grounded.

E. Hand dryer motor shall be a series commutated through-flow discharge vacuum motor/blower (5/8 HP / 20,000 RPM) which provides air velocity of 16,000 LFM (linear feet per minute) at the air outlet and 14,000 LFM at the hands (4 inches below air outlet).

F. Hand dryer heating element (900 W) is constructed of Nichrome wire and mounted inside the blower housing, thereby being vandal proof. It shall be protected by an automatic resetting thermostat, which shall open whenever air flow is cut off and shall close when flow of air is resumed. It shall produce an air temperature of up to 135°F (57°C) at a 72°F (22°C) ambient room temperature at the hands (4 inches [102 mm] below air outlet).

G. Hand dryer Control assembly is activated by an infrared optical sensor located next to the air outlet. The dryer shall operate as long as hands are under the air outlet. There is a 35-second lockout feature if hands are not removed.

2.3 OPERATION

A. Touch-free infra-red operation activation.

B. Hand dry time measurement: 12 seconds.

C. Operation lock out period: 30 seconds.

D. Operation airflow: up to 7.39 gal/sec.

E. Rated operating noise power: 84dB(A)

2.3 ELECTRICAL

A. Voltage: 115 volts, do not use shared neutral.

B. Power Consumption: 12.5 AMPS. Entire unit shall be internally grounded.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's recommendations and instructions.

END OF SECTION 268050